Economic Entomology

APTERA.

BY

ANDREW MURRAY, F.L.S.

LANE MEDICAL LIBRARY STANFORD
D1201 .M98
Economic entomology / by Andrew Murray,
OLD
24503454986

SOUTH KENSINGTON MUSEUM

SCIENCE HANDBOOKS

LANE
MEDICAL

LIBRARY
Gift
Dr.A.W.Bitting

A. W. Butting
Purdue
Oct 17 1894

GUSTAV E. STECHERT
810 Broadway
NEW-YORK.

SOUTH KENSINGTON MUSEUM SCIENCE HANDBOOKS.

ECONOMIC ENTOMOLOGY.

APTERA.

This is the first of a series of Handbooks intended to serve in the first instance as guides to the different branches of the Collection of Economic Entomology which is in course of formation at the Bethnal Green Branch of the South Kensington Museum, by order of the Lords of the Committee of Council on Education; and in the next place as practical treatises on the subject for the use of the public generally. The Collection has now become large enough to furnish a basis for such a work, and the order in which it is proposed to take up the other subjects is that followed in the published list of the contents of the collection, viz., the Aptera (spiders, mites, &c.), which form the subject of this handbook; then the Bugs; the Locusts, Grasshoppers, Cockroaches, and Earwigs; the Two-winged Flies; the Bees, Wasps, &c.; the Dragon-flies and May-flies; Butterflies and Moths; and, lastly, the Beetles.

ECONOMIC ENTOMOLOGY.

BY

ANDREW MURRAY, F.L.S.

APTERA.

Prepared at the request of the Lords of the Committee of Council on Education, and published for them

BY

CHAPMAN AND HALL, 193, PICCADILLY.

LAKE LIBRARY

ECONOMIC ENTOMOLOGY.

BY

ANDREW MURRAY, F.L.S.

APTERA.

DIVISION I.—*MYRIAPODS, SCORPIONS, SPIDERS, &c.*

Prepared at the request of the Lords of the Committee of Council on Education, and published for them

BY

CHAPMAN AND HALL, 193, PICCADILLY.

CONTENTS OF CASES DESCRIBED IN VOL. I.

CASE I.

CRUSTACEANS (likely to be mistaken for Insects).

NO.		SEE PAGE
1.	Oniscus asellus, specimens (15)	8
2.	Do., enlarged figure	,,
3.	Porcellio scaber, specimens (12)	10
4.	Do., enlarged figure	,,
5.	Armadillo vulgaris, specimens (12)	,,
6.	Do., enlarged figure extended	,,
7.	Do., enlarged figure rolled up	,,

INSECTS.

MYRIAPODS—JULIDÆ.

8.	Glomeris limbata (?), specimen (1)	14
9.	Do., enlarged figure	,,
10.	Sphæropœus (Zephronica, *Gray*) castaneus, specimens (3)	15
11.	Do., enlarged figure	,,
12.	Sphæropœus heterostictus, specimen (1)	,,
13.	Do., enlarged figure	,,
14.	Sphæropœus glabratus, specimen (1)	,,
15.	Orchid injured by such insects, figure	,,
16.	Julus guttatus, specimens in phial	16
17.	Do., enlarged figure	,,
18.	Carrot injured by them, figure	,,
19.	Lily roots injured by them, preserved in glycerine; specimens in phial	,,
20.	Do., model	,,
21.	Julus terrestris, specimen (1)	17
22.	Do. enlarged figure	,,
23.	Parsnip root injured by them; model	,,
24.	Julus londinensis, specimens (1 ?)	18
25.	Do., enlarged figure	,,
26.	Julus nitens, specimen (1)	,,
27.	Do., enlarged figure	,,

NO.		SEE PAGE
28.	Spirostreptus javanicus? specimen (1)	19
29.	Do., figure	,,
30.	Spirostreptus annulatipes, specimens (2)	,,
31.	Do., figure	,,
32.	Polydesmus complanatus, specimens (4)	20
33.	Do., enlarged figure	,,
34.	Polydesmus dorsalis, *aff.* Thomsoni, specimen (1)	,,
35.	Do., enlarged figure	,,
36.	Brachycybe rosea, California, specimen (1)	21
37.	Do., enlarged figure	,,

CASE II.

MYRIAPODS (*continued*).

SCOLOPENDRIDAE.

1.	Mecistocephalus punctifrons, East Indies, specimen (1)	22
2.	Geophilus longicornis, specimens (2)	,,
3.	Do., enlarged figure	,,
4.	Geophilus subterraneus, specimens in phial	23
5.	Do., enlarged figure	,,
6.	Illustrative vignette of phosphorescent light of do.	,,
7.	Scolopendra ceylonensis, Ceylon, specimens (2)	26
8.	Scolopendra platypoides, Brazil, specimens (2)	,,
9.	Scolopendra placeæ, Brazil, specimens (2)	,,
10.	Scolopendra variegata, Demerara, specimens (2)	,,
11.	Scolopendra angusticollis, Old Calabar, specimens (2)	27
12.	Scolopendra leachii, Cape Verd Islands, specimen (1)	,,
13.	Scolopendra tuberculidens, E. Indies, specimens (2)	,,
14.	Scolopendra cœruleo-viridis, Australia, specimens (2)	,,
15.	Do., enlarged figure	,,
16.	Cryptops hortensis, specimen (1)	28
17.	Do., enlarged figure	,,
18.	Lithobius forficatus, specimens (4)	,,
19.	Do., enlarged figure	,,
20.	Cermatia capensis, Cape of Good Hope, specimen (1)	30
21.	Do., enlarged figure	,,
22.	Cermatia smithii, New Holland, specimen (1)	,,
23.	Do., enlarged figure	,,

CASE III.

SCORPIONS AND THEIR ALLIES.

1.	Chelifer museorum, specimens (8)	34
2.	Do., enlarged figure	,,
3.	Chelifer geoffroyi, specimens (3)	35
4.	Do., enlarged figure	,,

NO.		SEE PAGE
5.	Scorpions (species of Androctonus), newly born, from Rangoon, specimens (3)	38
6.	Do., enlarged figure	,,
7.	Androctonus priamus (?), Java (?), specimens (2)	,,
8.	Androctonus, *Sp.*, East Indies, specimen (1)	,,
9.	Buthus, *Sp.*, Cape, specimens (2)	,,
10.	Buthus cæsar, E. Indies, specimens (2)	,,
11.	Buthus afer, specimen (1)	,,
12.	Buthus imperator, figure natural size	,,
13.	Phrynus ceylonicus, specimen (1)	39
14.	Do., figure natural size	,,
15.	Telyphonus giganteus, specimen (1)	,,
16.	Do., figure natural size	,,
17.	Telyphonus proscorpio, specimens (2)	40
18.	Do., figure natural size	,,
19.	Galeodes araneoides, specimen (0)	,,
20.	Do., figure natural size	,,
21.	Illustrative vignette, camel	,,

CASE IV.

SPIDERS.

1.	Mygale avicularia, Tropical S. America, specimen (0)	52
2.	Do., sketch of insect, natural size	,,
3.	Mygale californica, California, sketch of ditto	53
4.	Do., specimens of do.	,,
5.	Mygale fasciata, Java, sketch of insect	54
6.	Do., specimen (0)	,,
7.	Mygale klugii, Eastern Andes, specimen of insect, said to be very venomous	,,
8.	Do., sketch of ditto	,,
9.	Mygale versicolor, specimen of insect	,,
10.	Do., sketch of do., natural size	,,
11.	Mygale erichsoni, Java, specimen of insect	,,
12.	Do., sketch of do.	,,
13.	Mygale convexa, West Africa, specimen of insect	,,
14.	Atypus sulzeri, sketch of insect, the only British representative of the Mygalidæ	55
15.	Cteniza ionica, trap-door spider from South of Europe, nest of	56
16.	Do., sketch of insect	,,
17.	Actinopus nidulans, nest of, with specimens in the nest (2 broken)	,,
18.	Do., sketch of insect enlarged	,,
19.	Do., specimens of do., male and female (2)	,,
20.	Nemesia eleanora, diagram to show the double-branched nest of, with an outer and inner trap-door, South Europe	60

CASE V.

TRAP-DOOR NESTS OF SPIDERS.

From South of France. Presented by LADY JARDINE.

NO.		SEE PAGE
1.	Nemesia cæmentaria, cork trap-door nest made by do., door indicated by a straw in it	60–64
2.	Do. Do., key to, door coloured	,,
3.	Do., specimen of maker of cork trap-door nests (male)	,,
4.	Do., cork trap-door nest made by do., door indicated by a straw	,,
5.	Do. Do., key to, door coloured	,,
6.	Do., cork trap-door nest, straw in door	,,
7.	Do. Do., key to, door coloured	,,
8.	Do., specimen of female insect, maker of cork trap-door nest	,,
9.	Do., cork trap-door nest, straw in door	,,
10.	Do. Do., key to, door coloured	,,
11.	Nemesia eleanora, wafer trap-door nest with two doors, and an old inner tube door in lower right-hand corner	,,
12.	Do. Do., key to, outer doors coloured brown, old inner tube door blueish	,,
13.	Do., diagram showing a section of two doors of nest	,,
14.	Do., wafer trap-door nest with two entrances, part of old inner tube door in lower left-hand corner	,,
15.	Do. Do., key to, outer doors coloured brown, old inner tube door blueish	,,
16.	Do., wafer trap-door nest with two entrances, a straw in each door	,,
17.	Do. Do., key to, doors coloured	,,
18.	Do., specimen of male insect, maker of wafer trap-door nests	,,
19.	Do., wafer trap-door nest with two entrances, an old door of the inner second tube shown in upper corner to the left, a part of tube in upper right-hand corner	,,
20.	Do. Do., key to, the outer doors coloured brown; an inner door removed from second tube coloured white and blue; part of the tube shown in right-hand upper corner coloured pale brown	,,
21.	Do., wafer trap-door nest with two entrances, a straw in each door	,,
22.	Do. Do., key to, doors coloured	,,
23.	Do., specimen of female insect, maker of wafer trap-door nests; from Cannes	,,
24.	Do., wafer trap-door nest, injured and artificially repaired	,,
25.	Do. Do., key to, door coloured	,,
26.	Cteniza fodiens, magnified sketch of (one of the makers of cork trap-door nests	,,

NO. SEE PAGE
27. Magnified sketch of a cork trap-door 65
28. Nemesia eleanora, magnified sketch of insect, maker of the wafer trap-door nests . . . . . ,,
29. Magnified sketch of wafer trap-door . . . . . ,,

CASE VI.

SPIDERS (*continued*).

1. Mygale detrita, sketch of insect 65
2. Do., specimen of do. . . . . ,,
3. Latrodectes malmignatus, sketch of do. . . . . ,,
4. Lycosa tarantula, sketch of do. 68

GENERA OF BRITISH SPIDERS.

Family DYSDERIDAE.

5. Oonops pulcher, sketch of do. 69
6. Dysdera crocata (rubicunda, *Bl.*), specimen of do. 70
7. Do., sketch of do. . . . . ,,
8. Harpactes hombergii (Dysdera hombergii, *Bl.*), sketch of do. . . ,,
9. Segestria senoculata, sketch of do. . . . . ,,

Family DRASSIDAE.

10. Micaria pulicaria (Drassus micans, *Bl.*), sketch of do. . . . ,,
11. Drassus blackwallii (sericeus, *Bl.*), sketch of do. 71
12. Clubiona pallidula (epimelus, *Bl.*), sketch of do. . . . . ,,
13. Chiracanthum nutrix (non *Bl.*), sketch of do. . . . . ,,
14. Hecaërge maculata, sketch of do. . . . . ,,

Family DICTYNIDAE.

15. Eresus cinnabarinus, sketch of do. . . . . ,,
16. Dictyna arundinacea (Ergatis benigna, *Bl.*), sketch of do. . . 72
17. Do., sketch of cocoons of do. . . . . ,,

Family AGELENIDAE.

18. Argyroneta aquatica, sketch of do. . . . . ,,
19. Amaurobius ferox (Ciniflo ferox, *Bl.*), sketch of do. 75
20. Amaurobius (Ciniflo) mordax, sketch of do. 77
21. Agelena labyrinthica, sketch of do. . . . . ,,
22. Tegenaria guyonii (Tegenaria domestica, *Bl.*), sketch of do. . . 78

Family SCYTODIDAE.

23. Scytodes thoracica, sketch of do. 79

CASE VII.

GENERA OF BRITISH SPIDERS (*continued*).

NO.		SEE PAGE
	Family PHOLCIDAE.	
1.	Pholcus phalangoides, sketch of insect	79
	Family THERIDIIDAE.	
2.	Theridion tepidariorum, sketch of do.	80
3.	Do. riparium, sketch of tent and cocoons of do.	,,
	Family LINYPHIADAE.	
4.	Linyphia montana (marginata, *Bl.*), sketch of insect	82
5.	Walckenaëria pratensis, sketch of do.	,,
6.	Do., sketch of do.	,,
	Family EPEIRIDAE.	
7.	Eperia quadrata, sketch of do.	84
8.	Do. arbustorum, *Koch* (bicornis, *Bl.*)	,,
9.	Do. diademata (diadema, *Bl.*), sketch of do.	85
	Family ULOBORIDAE.	
10.	Uloborus walckenaërus (Veleda lineata, *Bl.*), sketch of do.	86
	Family THOMISIDAE.	
11.	Xysticus pini (Thomisus audax, *Bl.*), sketch of do.	88
12.	Thomisus onustus (abbreviatus, *Bl.*), sketch of do.	,,
13.	Diæa dorsata (Thomisus floricolens, *Bl.*), sketch of do.	,,
14.	Philodromus margaritatus (pallidus, *Bl.*), sketch of do.	,,
15.	Micrommata virescens (Sparassus smaragdulus, *Bl.*), sketch of do., male	,,
16.	Do., sketch of do., female	,,
	Family LYCOSIDAE.	
17.	Dolomedes fimbriatus, sketch of insect	89
18.	Trochosa cinerea (Lycosa allodroma, *Bl.*), sketch of do.	91
	Family SPHASIDAE.	
19.	Oxyopes lineatus (Sphasus lineatus, *Bl.*), sketch of do.	,,
	Family SALTICIDAE.	
20.	Epiblemum scenicum (Salticus scenicus, *Bl.*), sketch of do.	92
21.	Heliophanes cupreus (Salticus cupreus, *Bl.*), sketch of do.	,,
22.	Ballus depressus (Salticus obscurus, *Bl.*), sketch of do.	,,
23.	Salticus formicarius, sketch of do.	,,

CASE VIII.

MITES.

NO.	TROMBIDIINAE (TETRANYCHIDAE, Spinning Mites).	SEE PAGE
1.	Tetranychus telarius, red spider, sketch of larva	97
2.	Do. do., sketch of male	,,
3.	Do. do., sketch of female	,,
4.	Tetranychus lintearius, magnified sketch	104
5.	Tetranychus, *sp.*, on oak, magnified sketch	107
6.	Tetranychus fici, sketch of leaf attacked	,,
7.	Do., magnified sketch of insect	,,
8.	Tetranychus tiliarum, magnified sketch of insect	,,
9.	Do., leaf of lime attacked by do.	,,
10.	Tetranychus socius, magnified sketch of do.	108
11.	Tetranychus eriostemi, leaves of Eriostemon neriifolium attacked by do.	109
12.	Do., magnified sketch of leaf shewing the mischief	,,
13.	Do., twig shewing mischief on do.	,,
14.	Do., magnified sketch of do.	,,
15.	Do., magnified sketch of insect	,,
16.	Tetranychus autumnalis, magnified figure of young stage	,,
17.	Do., magnified figure of perfect insect, under side	,,
18.	Tetranychus trombidinus, enlarged figure of insect	114
19.	Raphignathus ruberrimus do.	,,
20.	Megamerus celer do.	116
21.	Tetranychus? americanus do.	,,
22.	Tetranychus? irritans do.	,,
23.	Petrobia lapidum, enlarged figure of young	118
24.	Do., enlarged figure of perfect insect	,,
25.	Eupodes celer, enlarged figure of young	121
26.	Do., enlarged figure of perfect insect	,,

CASE VIII².

1. Specimens of web of Tetranychus lintearius on furze bush, from Weybridge. The red dust on the web is dead mites . . . 104

CASE IX.

MITES (*continued*).

TROMBIDIIDAE, Harvest Mites.

1.	Linopodes longipes, magnified sketch of insect		122
2.	Linopodes ravus	do.	123
3.	Linopodes cursorius	do.	,,
4.	Rhyncholophus cinereus	do.	125
5.	Rhyncholophus phalangioides	do.	,,
6.	Rhyncholophus major	do.	126

NO.		SEE PAGE
7.	Smaridia papillosa, magnified sketch of insect	127
8.	Pachygnathus velatus do.	128
9.	Trombidium parasiticum do.	129
10.	Trombidium holosericeum (phalangii, *Dug.*), magnified sketch of larva	,,
11.	Do., magnified sketch of perfect insect	,,
12.	Do., specimen of do.	,,
13.	Do., magnified sketch of perfect insect, copied from figure by Walckenaër	,,
14.	Do., *var.* trigonum, magnified sketch of perfect insect	133
15.	Trombidium curtipes do.	134
16.	Trombidium fuliginosum do.	,,
17.	Trombidium bicolor do.	135
18.	Trombidium fasciculatum do.	,,
19.	Do. do., specimens of do. (4)	,,
20.	Trombidium tinctorium, magnified sketch of do.	,,
21.	Do. do., specimens of do. (6)	,,
22.	Trombidium gryllarium, magnified sketch of larva of do., feeds on Rocky Mountains locusts	136
23.	Trombidium sericeum, magnified sketch of do., perhaps male insect of preceding	138
24.	Trombidium miniatum, magnified sketch of perfect insect	139
25.	Trombidium aurantiacum, do. of larva	,,
26.	Erythræus ruricola, do. of perfect insect	141
27.	Actineda cornigera, do. do.	,,

CASE X.

MITES (*continued.*)

BDELLIDAE.

1.	Molgus longicornis, England, sketch of insect	143
2.	Scirus insectorum, magnified sketch of larva of do.	145
3.	Scirus hexophthalmus, France, magnified sketch of do.	146
4.	Scirus obisium, France, magnified sketch of do.	,,
5.	Scirus vestitus, magnified sketch of do.	,,

HYDRACHNIDAE (Fresh Water Mites).

6.	Limnochares aquaticus, Europe, magnified sketch of mature insect	148
7.	Eylais extendens, Europe, magnified sketch of freshly hatched larva	150
8.	Do. do. do.	,,
9.	Hydrachna geographica, magnified sketch of insect	152
10.	Diplodontus scapularis, Europe, magnified sketch of larva	153
11.	Do. do. do.	,,

NO. SEE PAGE
12. Hydrochoreŭtes globulus, magnified sketch of first stage of larva . 153
13. Belostoma grandis, E. Indies, specimens with nymphs of Hydrachna adhering to various parts of its body (2) . . . . . ,,
14. Hydrochoreŭtes globulus, magnified sketch of water-bug shewing larva in the nymph stage adhering to it . . . . . ,,
15. Do., magnified sketch of nymph stage of do. . . . . ,,
16. Do., magnified sketch of mature insect 154
17. Atax Bonzi, magnified sketch of newly developed larva . . . 155
18. Atax globator, Europe (Denmark), magnified sketch of male insect . . . . . ,,
19. Do., magnified sketch of female . . . . . ,,
20. Atax buccinator, Denmark, magnified sketch of insect . . . ,,
21. Atax miniata, Europe, magnified sketch of insect . . . . ,,
22. Atax varipes do. do. . . . . ,,
23. Atax histrionicus, Europe, magnified sketch of male 156
24. Do. do. magnified sketch of female . . . . . ,,
25. Pontarachna punctulum, Mediterranean, near Naples, magnified sketch of insect . . . . . ,,

CASE XI.

MITES (*continued*).

GAMASIDAE.

1. Gamasus coleoptratorum, magnified figure of 158
2. Do. specimens (2) . . . . . ,,
3. Gamasus marginatus, magnified sketch 159
4. Do., specimen (1) . . . . . ,,
5. Gamasus quadripunctatus, magnified sketch 161
6. Do., specimen (1) . . . . . ,,
7. Gamasus crassipes, magnified sketch . . . . . ,,
8. Gamasus tetragonoides, do. . . . . ,,
9. Gamasus podager, do. . . . . ,,
10. Do., specimen (1) . . . . . ,,
11. Uropoda vegetans, magnified figure 162
12. Do., specimens . . . . . ,,
13. Sejus marinus, magnified sketch 167
14. Halarachne halichœri, magnified sketch of larva . . . . ,,
15. Do. do., perfect insect . . . . . ,,
16. Dermanyssus nitzschii, magnified sketch 169
17. Dermanyssus avium, magnified sketch of empty . . . . ,,
18. Do., specimens of do. (2) . . . . . ,,
19. Do. Vignette of chickens ("realistic chick") . . . . ,,

NO.		SEE PAGE
20.	Dermanyssus avium, magnified sketch of insect full fed	169
21.	Do., specimen of (1)	,,
22.	Dermanyssus pipistrellæ, magnified figure	172
23.	Dermanyssus agilis, magnified sketch	174
24.	Pteroptus (Tinoglischrus) audouinii, magnified sketch	178
25.	Pteroptus (Diplostaspis) vespertilionis, do.	179
26.	Do., specimens (0)	,,
27.	Argas pipistrellæ, magnified sketch	180
28.	Do. reflexus, do.	181
29.	Do. persicus, do.	,,
30.	Do. americanus, do.	182
31.	Do. moubata, do.	,,
32.	Ornithodoros coriaceus, magnified sketch	183
33.	Do. talaje, do. do.	,,

CASE XII.

MITES (*continued*).

IXODIDAE (Ticks).

1.	Ixodes erinaceus, male, enlarged figure, Britain	190
2.	Do., specimens (5)	,,
3.	Do., female, half full, enlarged figure	,,
4.	Do., specimens in phial (11)	,,
5.	Do., female, full fed, enlarged figure	,,
6.	Do., specimens in phial (5)	,,
7.	Ixodes marginatus, male, enlarged figure	192
8.	Do., specimens (3)	,,
9.	Do., female, enlarged figure	,,
10.	Do., female, specimens (7)	,,
11.	Ixodes ricinus, from Continent, enlarged sketch copied from Koch's figure	193
12.	Ixodes reduvius, enlarged figure of female, copied from Audouin's figure	,,
13.	Ixodes trabeatus, enlarged figure of female, do.	,,
14.	Ixodes bovis, male, enlarged figure, N. America	,,
15.	Do., female, do.	,,
16.	Do., specimen (1)	,,
17.	Ixodes brevipes, Ceylon, Steppes of Aral, enlarged figure of female	194
18.	Do., specimens (2)	,,
19.	Ixodes distipes, Tunis, enlarged figure of female	,,
20.	Do., specimen (1)	,,
21.	Ixodes transversalis, from under orbit of Python, enlarged figure	195

NO.		SEE PAGE
22.	Ixodes transversalis, enlarged sketch of head of Python, to show where I. transversalis taken from	195
23.	Hyalomma cornuger, *Kol.*, do.	196
24.	Adenopleura compressum, enlarged figure of do., W. Africa	200
25.	Amblyomma rostratum, Old Calabar, enlarged figure of	201
26.	Do., specimen (1)	,,
27.	Amblyomma rotundatum, the Carapato from Brazil, enlarged figure of	,,
28.	Do., specimen (1)	,,
29.	Amblyomma pacificum, Sandwich Isles, enlarged figure of	203
30.	Do., specimen (1)	,,
31.	Ophiodes ophiophilus, S. Africa, enlarged figure of	204
32.	Ophiodes gervaisii, male, enlarged figure	,,
33.	Do., female, do.	,,
34.	Ophiodes gracilentus, from Python Sebae, enlarged figure	,,
35.	Ophiodes flavomaculatus, from Python Sebae, enlarged figure	,,
36.	Do., vignette sketch of Python Sebae, from W. Africa	,,

CASE XIII.

MITES (*continued*).

HALACARIDAE (Marine Mites) AND ORIBATIDAE.

1.	Halacarus ctenopus, magnified sketch of insect, British sea shores	208
2.	Halacarus falcatus, magnified sketch of insect	,,
3.	Halacarus sculptus, do.	209
4.	Halacarus rhodostigma, magnified sketch of insect	210
5.	Halacarus notops, magnified sketch of insect	211
6.	Damæus geniculatus, magnified sketch of embryo, common in Europe, fresh from egg of do.	215
7.	Do., magnified sketch of larva	,,
8.	Do., sketch and specimens of perfect insect	,,
9.	Damæus auritus, magnified sketch of perfect insect	216
10.	Leiosoma nitens, do., France	,,
11.	Notaspis bipilis, do., very common in France	217
12.	Oribata orbicularis, do., common near Paris	,,
13.	Oribata globula, do., near Paris	218
14.	Pelops acromios, magnified sketch of larva, near Paris	219
15.	Do., magnified sketch of perfect insect	,,
16.	Nothrus spiniger, magnified sketch of larva, common on the Continent	,,
17.	Do., magnified sketch of perfect insect	,,
18.	Nothrus horridus, do., very common amongst moist mosses in France	220
19.	Hermannia crassipes, magnified sketch of larva, common near Paris	221

NO.		SEE PAGE
20.	Hermannia crassipes, magnified sketch of perfect insect	221
21.	Cepheus vulgaris, do., common on the Continent	222
22.	Eremæus tibialis, magnified sketch of larva, France	,,
23.	Hoplophora contractilis, magnified sketch of larva	,,
24.	Do., magnified sketch of perfect insect	,,
25.	Do., contracted	,,

CASE XIV.

MITES (*continued*).

ACARIDAE, 1st Section, TYROGLYPHIDAE (Cheese Mites, &c.)

1.	Hypoderas brevis, enlarged sketch of insect taken from under the skin of Ardea nyticorax	229
2.	Hypoderas lineatus, enlarged sketch of insect	230
3.	Hypopus (Acarellus) muscæ, do.	250
4.	Hypopus (Acarellus) pulicis, do.	,,
5.	Trichodactylus xylocopæ, do.	252
6.	Homopus elephantis do.	253
7.	Rhizoglyphus echinopus (dujardinii), magnified sketch of larva and pupa	257
8.	Do., magnified sketch of male, after Claparède	,,
9.	Do., magnified sketch of female do.	,,
10.	Do. do. after Robin	,,
11.	Rhizoglyphus robinii, magnified sketch of insect	259
12.	Tyroglyphus entomophagus, sketch showing do. in various stages, and its eggs, &c.	263
13.	Do., magnified sketch of insect	,,
14.	Tyroglyphus siro, do.	267
15.	Tyroglyphus longior, do.	270
16.	Tyroglyphus malus, magnified figure of insect	275
17.	Glyciphagus prunorum, magnified sketch of insect	277
18.	Glyciphagus cursor, do.	278
19.	Glyciphagus hippopodos, do.	279
20.	Glyciphagus spinipes, do.	281
21.	Glyciphagus plumiger, do.	283
22.	Glyciphagus palmifer, do.	284
23.	Cheyletus eruditus, sketch of under side magnified	286
24.	Heteropus ventricosus, magnified sketch of perfect insect newly developed	290
25.	Do., much magnified sketch of female parasite in the nests of Anthophora retusa	,,

CASE XV.

MITES (*continued*).

SARCOPTIDAE (Itch and Louse Mites.)

NO.		SEE PAGE
1.	Sarcoptes scabiei, eggs of do., one opened showing the embryo	292
2.	Do., magnified diagram of the itch-insect's burrow in the human skin, with the insect at the further end and egg-shells and debris behind	,,
3.	Do., magnified sketch of male, upper side	,,
4.	Do., of female, under side	,,
5.	Sarcoptes cati, magnified sketch of male (S. cuniculi, *Gerl.*, S. minor, Furst.)	302
6.	Sarcoptes mutans, magnified sketch of male, upper side	305
7.	Do., male, side view	,,
8.	Do., female, under side	,,
9.	Psoroptes equi (Dermatokoptes communis, Furst.), magnified sketch of male, upper side	308
10.	Symbiotes bovis, magnified sketch of male, underside (Dermatophagus bovis, Furst)	313
11.	Sarcoptes nidulans, magnified sketch of insect	314
12.	Myobia musculi, magnified sketch of male	315
13.	Do., magnified sketch of mandibles, adapted for holding hairs	,,
14.	Listrophorus gibbus, magnified sketch of insect	325
15.	Listrophorus leuckarti, do.	,,
16.	Myocoptes musculinus, magnified sketch of male and female	326
17.	Do., magnified sketch of female	,,
18.	Dermaleichus, *sp.*, magnified sketch of male	328
19.	Do., *sp.*, do. of female	,,
20.	Dermaleichus pici-majoris, do. of male	329
21.	Do., do. of female	,,
22.	Dermaleichus chelopus, magnified sketch of insect	,,
23.	Demodex folliculorum, do.	,,
24.	Do., magnified sketch of sebaceous follicle and bulb of human hair, showing the place where Demodex folliculorum is found	,,

CASE XVI.

MITES (*continued*).

PHYTOPTI, Gall Mites.

1.	Phytoptus taxi, sketch of yew-tree twig with buds attacked by do.	354
2.	Magnified sketch of Phytoptus taxi	,,
3.	Do. of section of bud of yew tree attacked by do.	,,
4.	Do. specimen from which sketch taken	,,

NO. SEE PAGE

5. Phytoptus coryli (Calycophthora avellanæ, *Amer.*), hazel buds attacked by do. 354
6. Do., sketch of buds so attacked . . . . . ,,
7. Phytoptus persicæ, sketch of twig and buds of peach tree suffering from "le meunier," supposed to be a species of Phytoptus . . ,,
8. Phytoptus ribis, currant buds attacked by 355
9. Do., sketch of do. . . . . ,,
10. Do., magnified sketch of first stage of larva . . . . . ,,
11. Do., do. of second stage . . . . . ,,
12. Phytoptus tiliæ, lime tree leaf nail gall, specimen of gall on leaf . 356
13. Do., sketch of leaf with galls . . . . . ,,
14. Do., magnified sketch of galls . . . . . ,,
15. Do., magnified section of a gall . . . . . ,,
16. Do., magnified figure of the insect, copied from Dujardin's figure . . . . . ,,
17. Phytoptus (Volvulifex) aceris, sycamore leaf bearing galls of do. . ,,
18. Do. sketch of leat with do. . . . . ,,
19. Do., sketch of leaf of variety of sycamore (P. Leopoldi), with galls on do. . . . . ,,
20. Do., specimen of do. . . . . ,,
21. Do., under side of sycamore leaf, showing galls on do. . . ,,
22. Do., sketch of do. . . . . ,,
23. Do., magnified section of gall of do. . . . . ,,
24. Phytoptus myriadeum (Cephaloneon myriadeum, *Br.*), specimen of leaves of common maple, with galls on do. 357
25. Do., sketch of do. . . . . ,,

CASE XVII.

MITES (*continued*).

PHYTOPTI (*continued*).

1. Phytoptus (Typhlodromus) pyri, sketch of leaf of pear tree bearing galls of do. 358
2. Do., specimens of do. . . . . ,,
3. Do., magnified section of gall of do. . . . . ,,
4. Do., magnified sketch of larva of do., after Scheuten . . . ,,
5. Do., perfect insect, do. . . . . ,,
6. Phytoptus attenuatus (Ceratoneon attenuatum), leaves of sloe bearing galls of do. . . . . ,,
7. Do., sketch of do. . . . . ,,
8. Phytoptus (Volvulifex) pruni, leaves of plum bearing galls of do. . 360
9. Do., sketch of leaf of do. . . . . ,,

NO. SEE PAGE
10. Phytoptus (Volvulifex) pruni, magnified section of gall of do., showing no inhabitants and filled with hairs 360
11. Phytoptus salicis, leaves of black sallow bearing galls of do. . . . 361
12. Do., sketch of do. . . . . ,,
13. Do., magnified sketch of do. . . . . ,,
14. Do., magnified section of gall of do. . . . . ,,
15. Do., magnified sketch of insect . . . . . ,,
16. Erineum tiliæ, a growth on the lime-tree leaf produced by hypertrophy, and often mistaken for work of an insect 374
17. Æcidium abietinum, a fungus growing on leaf of Picea cephalonica, sometimes mistaken for insect work . . . . . ,,
18. Do., magnified sketch of do. . . . . ,,
19. Rœstelia lacerata, a fungoid growth on hawthorn leaf . . . . ,,
20. Do., magnified sketch of do. . . . . ,,
21. Rœstelia cancellata, first stage of a fungus growth on pear tree leaves, often mistaken for insect work . . . . . ,,
22. Do., sketch of do. . . . . ,,
23. Do., second stage of growth on pear tree leaves, upper side of leaf . . . . . ,,
24. Do., under side of leaf . . . . . ,,

CASE XVIII.

ANOPLURA—Lice.

MALLOPHAGA.

1. Menopon pallidum, specimens 376
2. Do., enlarged figure . . . . . ,,
3. Do., illustrative vignette (cocks and hens) . . . . ,,
4. Menopon perdricis 377
5. Do., enlarged figure . . . . . ,,
6. Do., illustrative vignette (partridge) . . . . . ,,
7. Menopon fulvo maculatum, specimens . . . . . ,,
8. Do., enlarged figure . . . . . ,,
9. Do., illustrative vignette (quail) . . . . . ,,
10. Trinoton luridum, specimens 378
11. Do., enlarged figure . . . . . ,,
12. Do., illustrative vignette (duck) . . . . . ,,
13. Nirmus cameratus, specimens 379
14. Do., enlarged figure . . . . . ,,
15. Do., illustrative vignette (black cock and grey hen) . . . . ,,
16. Nirmus claviformis, specimens . . . . . ,,
17. Do., enlarged figure . . . . . ,,
18. Do., illustrative vignette (carrier pigeon) . . . . ,,

NO.		SEE PAGE
19.	Goniocotes hologaster, specimens	380
20.	Do., enlarged figure	,,
21.	Do., illustrative vignette (fowl dusting)	,,
22.	Goniodes falcicornis, specimens of young insect	,,
23.	Do., enlarged figure	,,
24.	Do., specimens of mature insect	,,
25.	Do., enlarged figure of do.	,,
26.	Do., illustrative vignette (peacock)	,,
27.	Goniodes stylifer, specimens	,,
28.	Do., enlarged figure	,,
29.	Do., illustrative vignette (turkey)	,,
30.	Goniodes numidianus, specimens	,,
31.	Do., enlarged figure	,,
32.	Do., illustrative vignette (guinea fowl)	,,
33.	Goniodes colchici, specimens	,,
34.	Do., enlarged figure	,,
35.	Do., illustrative vignette (pheasant)	,,
36.	Goniodes dissimilis, specimens	381
37.	Do., enlarged figure	,,
38.	Do., illustrative vignette (fowl)	,,
39.	Goniodes tetraonis, specimens	,,
40.	Do., enlarged figure	,,
41.	Do., illustrative vignette (grouse)	,,
42.	Lipeurus stellaris, specimens	,,
43.	Do., enlarged figure	,,
44.	Do., illustrative vignette (pigeons)	,,
45.	Lipeurus variabilis, specimens	382
46.	Do., enlarged figure	,,
47.	Do., illustrative vignette (chickens)	,,
48.	Lipeurus jejunus, specimens	,,
49.	Do. enlarged figure	,,
50.	Do. illustrative vignette (geese)	,,
51.	Lipeurus polytrapezius, specimens	,,
52.	Do., enlarged figure	,,
53.	Do., illustrative vignette (teal)	,,
54.	Ornithobius cygni, specimens	383
55.	Do., enlarged figure	,,
56.	Do., illustrative vignette (swan)	,,

CASE XIX.

ANOPLURA (*continued*).

MALLOPHAGA (*continued*) AND HAEMATOPINA.

NO.		SEE PAGE
1.	Trichodectes similis, specimens	383
2.	Do., enlarged figure	,,
3.	Do., illustrative vignette (red deer)	,,
4.	Trichodectes longicornis, specimens (4)	,,
5.	Do., enlarged figure	,,
6.	Do., illustrative vignette (fallow deer)	,,
7.	Trichodectes sphærocephalus, specimens	,,
8.	Do., enlarged figure	,,
9.	Do., illustrative vignette (sheep)	,,
10.	Trichodectes scalaris, specimens	384
11.	Do., enlarged figure	,,
12.	Do., illustrative vignette (cow)	,,
13.	Trichodectes equi	,,
14.	Do., enlarged figure	,,
15.	Do., illustrative vignette (horse)	,,
16.	Trichodectes latus, specimens (4)	,,
17.	Do., enlarged figure	,,
18.	Do., illustrative vignette (dog)	,,
19.	Trichodectes subrostratus, specimens (4)	,,
20.	Do., enlarged figure	,,
21.	Do., illustrative vignette (cat)	,,
22.	Hæmatomyzus elephantis, specimen (1)	385
23.	Do., enlarged figure	,,
24.	Do., illustrative vignette (elephant)	,,
25.	Hæmatopinus acanthopus, specimens (2)	386
26.	Do., enlarged figure	,,
27.	Do., illustrative vignette (field mouse)	,,
28.	Hæmatopinus spinulosus, specimens (eggs and insects)	,,
29.	Do., enlarged figure of ditto	,,
30.	Do., illustrative vignette (brown rat)	,,
31.	Hæmatopinus ventricosus, specimens (2)	,,
32.	Do., enlarged figure	,,
33.	Do., illustrative vignette (rabbit)	,,
34.	Hæmatopinus lyriocephalus	,,
35.	Do., enlarged figure	,,
36.	Do., illustrative vignette (hare)	,,
37.	Hæmatopinus suis, specimens (3)	,,
38.	Do., enlarged figure	,,
39.	Do., illustrative vignette (sow)	,,
40.	Hæmatopinus vituli, specimen	387

NO.		SEE PAGE
41.	Hæmatopinus vituli, enlarged figure	387
42.	Do., illustrative vignette (calf)	,,
43.	Hæmatopinus eurysternus, specimens (several)	,,
44.	Do., enlarged figure	,,
45.	Do., illustrative vignette (cattle)	,,
46.	Hæmatopinus asini, specimens (4)	388
47.	Do., enlarged figure	,,
48.	Do., illustrative vignette	,,
49.	Hæmatopinus piliferus, specimens (4)	,,
50.	Do., enlarged figure	,,
51.	Do., illustrative vignette (dog)	,,
52.	Hæmatopinus quadrumanus, specimens (4)	389
53.	Do., enlarged figure	,,
54.	Do., illustrative vignette (monkey)	,,

CASE XX.

ANOPLURA (*continued*).

PEDICULI, Lice of Man.

1.	Phthirius inguinalis, crab louse, specimens of insect	389
2.	Do., sketch of do.	,,
3.	Pediculus vestimenti, the body louse, European variety, specimens of insect	394
4.	Do., sketch of do.	,,
5.	Do., specimen of insect on a glass slide	,,
6.	Do., anterior claw of do., much magnified	,,
7.	Pediculus capitis, head louse, European variety, specimens of insect (o)	399
8.	Do., sketch of do.	,,
9.	Do., specimen of insect on a glass slide	,,
10.	Do., anterior claw of do., much magnified	,,
11.	Do., vignette sketch, European race	,,
12.	Pediculus capitis, Esquimaux variety, specimens of insect (o) and vignette sketch of do.	,,
13.	Do., specimen of insect on a glass slide	,,
14.	Do., of anterior claw, much magnified	,,
15.	Do., vignette sketch, Esquimaux	,,
16.	Pediculus capitis, Californian variety, specimens of insect	400
17.	Do., sketch of do.	,,
18.	Do., specimen of insect on a glass slide	,,
19.	Do., of anterior claw, much magnified	,,
20.	Do., vignette sketch, Californian Indian	,,
21.	Pediculus capitis, Andian variety, Quito, specimens of insect	,,
22.	Do., sketch of do.	,,

NO.		SEE PAGE
23.	Pediculus capitis, Andian variety, specimen of insect on a glass slide.	400
24.	Do., of anterior claw, much magnified	,,
25.	Do., vignette sketch, South American Indian	,,
26.	Pediculus capitis, Fuegian variety, specimens of insect (o)	,,
27.	Do., sketch of do.	,,
28.	Do., specimen of insect on a glass slide	,,
29.	Do., sketch of anterior claw, much magnified	,,
30.	Do., vignette sketch, Fuegians	,,
31.	Pediculus capitis, West African variety, specimens of insect (o)	,,
32.	Do., sketch of do.	,,
33.	Do., specimen of insect on a glass slide	,,
34.	Do., of anterior claw, much magnified	,,
35.	Do., vignette sketch, West African Negro	,,
36.	Pediculus capitis, Mozambique variety, specimen of insect	,,
37.	Do., sketch of do.	,,
38.	Do., specimen of insect on a glass slide	,,
39.	Do., of anterior claw, much magnified	,,
40.	Do., vignette sketch, Mozambique Africander.	,,
41.	Pediculus capitis, specimens of insect, Hindoo variety	,,
42.	Do., sketch of do.	,,
43.	Do., specimen of insect on a glass slide	,,
44.	Do., of anterior claw, much magnified	,,
45.	Do., vignette sketch, Hindoo Brahmin	,,
46.	Pediculus capitis, Australian variety, specimens of insect	,,
47.	Do., sketch of do.	,,
48.	Do., specimen of insect on a glass slide	,,
49.	Do., of anterior claw, much magnified	,,
50.	Do., vignette sketch, Australian	,,
51.	Vignette sketch, Causes of vermin: Dirt and over crowding	,,
52.	Do., Causes of vermin: Misery	,,
53.	Do., Causes of vermin: Disease	,,
54.	Do., Remedies, Cleanliness, &c.	,,

CASE XXI.

THYSANURA.—(Spring-tails).

COLLEMBOLA.

1.	Smynthurus fuscus, sketch of insect	406
2.	Papirius ornatus, do.	408
3.	Do. fuscus, do.	,,
4.	Orchesella cincta, specimens of insect	,,
5.	Do. sketch of do.	,,
6.	Do. do.	,,

NO.		SEE PAGE
7.	Tomocerus longicornis, sketch of insect	409
8.	Do., sketch of magnified scale of do.	,,
9.	Tomocerus plumbeus, sketch of insect	,,
10.	Seira buskii, do.	410
11.	Do., sketch of scale of do. magnified	,,
12.	Templetonia crystallina, sketch of insect	,,
13.	Beckia argentea, do.	,,
14.	Lepidocyrtus curvicollis do.	,,
15.	Do. magnified scale of do.	,,
16.	Degeeria annulata, sketch of insect	411
17.	Isotoma viatica, sketch of insect	,,
18.	Isotoma grisea, do.	412
19.	Achorutes purpurascens do.	,,
20.	Podura aquatica do.	,,
21.	Lipura fimetaria do.	,,
22.	Anoura muscorum do.	414
23.	Anoura granaria do.	,,
	LEPISMIDAE.	
24.	Campodea staphylinus do.	415
25.	Japyx solifugus do.	,,
26.	Lepisma saccharina do.	416
27.	Do., sketch of magnified scale of do.	,,
28.	Machilis maritima, sketch of insect	,,
29.	Do. sp., sketch of magnified scale of do.	,,

*** THE FOLLOWING NEW GENERA AND SPECIES ARE DESCRIBED IN THIS VOLUME.

	PAGE
Julus nitens	18
Polydesmus dorsalis	20
Brachycybe rosea	21
Scolopendra angusticollis	27
Scolopendra cœruleoviridis	27
Tetranychus eriostemi	109
Genus Petrobia	118
Gamasus quadripunctatus	161
Gamasus podager	161
Argas moubata	182
Ixodes brevipes	194
Ixodes distipes	194
Genus Xiphiastor	201
Xiphiastor rostratus	201
Amblyomma pacificum	203
Genus Ophiodes	204
Family Halacaridæ	208

ECONOMIC ENTOMOLOGY.

INTRODUCTION.

Economic Entomology is the science that treats of insects which affect man and his interests. In a wide sense every insect may be said to affect man, for those which appear to have no direct relation to him, may still affect him by giving pleasure by their external beauty, or instruction by their anatomy and physiology, but so far as regards the collection in the Bethnal Green Branch of the South Kensington Museum, of which this work is the exponent, the term has been used in its more restricted signification as applicable only to insects that directly affect him in his material interests—under which head the personal comfort of himself and his dependents, the profit to be made from them, or the damage done by them, are included.

The number of insects that directly contribute to his benefit is small; but that of those that directly injure him and the objects in which he has an interest is very great—as is the number of those that indirectly assist and benefit him by waging war upon these enemies.

There are unfortunately no means of distinguishing by a short definition the former from the latter. In mammals, we can tell by the teeth whether any species is carnivorous or herbivorous; and at first sight it would appear that we should be able to do the same with insects by the parts of the mouth. If herbivorous, we should set them down as hurtful; while those that are carnivorous should be regarded as our friends, for they principally feed on

vegetable-devouring insects. Many difficulties, however, stand in the way of our determining which belong to one class and which to the other, for paradoxical exceptions, which can only be likened to the occurrence of herbivorous carnivora or carnivorous herbivora, or both at one and the same time, or at one time one and at another the other, from time to time meet us, and there are no means of saying *a priori* whether and when we are dealing with such a case or not. Nothing but experience can enable us to do so, and it is one of the objects of the collection to which this is to serve as a Guide to assist those who desire it to acquire that information.

It may be proper to say a word or two in explanation of some of the peculiar features of the collection and the reasons for their adoption. The collection being destined for the instruction of the people, it was of course desirable that it should be displayed in such a manner as would be readily accessible and easily examined, and upright cases open to view have been thought best adapted for this purpose. The colours of insects are so evanescent under exposure to the light, and the specimens themselves are so fragile and subject to decay, that they are generally kept in closed drawers or cases. The experience which the Museum authorities have had with a case of silk-spinning moths, which are so preserved in a locked case (accessible on application), has shewn, however, that a collection so preserved would be practically sealed to the great majority of the visitors to the Museum. They will not take the trouble to apply to see it. The collection has therefore been made open to the public view, and the inconveniences thence arising are endeavoured to be removed by occasional renewal of specimens and by giving along with each insect a coloured representation of it, more or less magnified according to the size of the insect—which, in the case of minute insects, would be absolutely indispensable to allow their appearance to be seen at all, and in larger ones has the advantage of allowing the various parts to be more distinctly seen, and the

important ones to be brought more prominently into view. No figure, however, can convey a knowledge of the creature equal to that to be derived from a glance at the specimen itself. The purpose has been, therefore, always to place specimens of the actual insect alongside of the coloured figures; and where this has not been done, the omission is to be referred to the incompleteness of a collection only in progress of formation, not to intention or neglect. For the same reason models of injuries done to perishable objects have been added.

The system of displaying the collection in cases, if it has its advantages to the public, has one serious inconvenience to the maker of the collection. He cannot go straight forward with his subject as in the pages of a book, leaving off in the middle of a word or a subject at the bottom of the page or case. Each case requires to be treated as a separate subject or chapter of a subject or paragraph of a chapter. It must, to a certain extent, be complete within itself. A new subject cannot be well introduced on the last line of the case, even although the subject is finished: and still the case must be filled.

This special difficulty has been met without the introduction of irrelevant matter, occasionally by the addition of kindred species, which throw light upon the relations of the insects under consideration (although they may themselves have no strict right to a place under the head of Economic Entomology), and at other times by the introduction of vignettes and tail pieces. These have been intentionally made rather of a bright and cheerful character with the view of catching the eye of the passer-by, who might not otherwise deign to pay any attention to what he may consider a dry and uninviting subject, and with the hope that when so arrested he may extend his observations to the surrounding objects.

It is unnecessary to say that neither the collection nor this work has any pretensions to being a work on Systematic Entomology. Those who wish for information on that subject

must have recourse to the authors who treat of it. It is only when (as in the case of the mites, for example,) there is no general work treating of a particular branch of the subject that it has then been gone into with some greater attempt at detail; but the collection is arranged according to the most approved modern system, with this qualification, that it has sometimes, though rarely, been made to bend so far as to bring together the species of one group, that attack one particular kind of plant, instead of dispersing them among several according to their structural peculiarities.

Where a cypher (o) is appended to any object in the Catalogue, it means that specimens are intended to be placed in the collection but have not yet been procured.

ANDREW MURRAY.

HURTFUL ANIMALS ALLIED TO OR LIKELY TO BE MISTAKEN FOR INSECTS.

CASE I.

CRUSTACEANS.

THE collection begins with two or three species of crustaceans which are injurious to the horticulturist. These are not insects, but they occupy the nearest and most projecting point of the great region of the animal kingdom which lies next them. It is as if two great continents lay opposite to each other, one inhabited by insects and the other by crustaceans; and as a traveller in beginning the account of his journey starts with the port from which he sailed, so it is desirable, in treating of insects, to begin by endeavouring to trace the source from which they most probably originally came. By doing so we shall connect the two kindred nations of crustaceans and insects together. Starting from the crustaceans we shall reach the insects through two routes or resting-points—islands, as it were, lying in the ocean between their respective continents, viz., the Spiders and their allies, and the Thysanura and theirs, both lying much nearer the insect coast than the crustacean—so near, indeed, that there need be no hesitation in classing them among insects, which accordingly has been done here, and yet so distinct that they cannot be so placed without explanation and qualification.

The Crustaceans, then, consist of that class of animals of which the crab, lobster, and shrimp are our most familiar examples They possess many characters which are common to insects, such as an external skeleton or shell, articulated bodies and limbs, and the same mode of articulation; but are, for the most part, sufficiently different in appearance from them. Some, however,

CASE I. bear considerable resemblance to some insects, and perhaps the family of Oniscidæ comes nearest to them of any. They belong to the order Isopoda, or equal-footed crustaceans, which, unlike the crab and lobster with unequal claws, are provided with feet of equal size on each side of the body. The Oniscidæ have numerous segments and feet, and a number of them possess the faculty of rolling themselves up in a ball like a pill.

Order ISOPODA.

Family ONISCIDÆ.

Nos. 1, 2. ONISCUS ASELLUS (*Linn.*).—**1.** Specimens (6), (15); **2.** Enlarged figure of ditto.

Oniscus asellus (rather magnified).

Antenna of Oniscus asellus.

This and its allied species are known as wood-lice or slaters in this country, and sow-bugs in America. They are very common, and may be found under stones or in moist and dark places of concealment. The present species does not roll itself up in a ball, in this respect differing from some of the others. Its external antennæ (for, unlike insects, most crustaceans have four antennæ, while insects have only two) consist of eight joints, the last elbow of the antennæ being divided into three, while the allied genera Porcellio and Armadillo have only seven, the last elbow being divided into two. Like other crustaceans, it carries its eggs in a thoracic pouch, and a whole family of young ones freshly hatched may be found huddled up on the under side of the mother. They are almost omnivorous, and are no doubt of considerable use as

CASE I. scavengers, clearing away both vegetable and animal detritus; but they do not confine themselves to dead or decaying matter. They also attack living plants, peaches, melons, mushrooms, and anything that is juicy, doing more mischief by disfiguring the fruit than by the quantity they consume. They are also very partial to orchids, eating the young fibrils of the roots, especially of such as Cattleyas, that require to be kept dry when not in active growth, but which, nevertheless, make a good deal of root-growth at that period. When numerous they will destroy almost every root that is made on the surface of the pots, rendering the growth which follows small and weak. To them, too, is often due the loss of some spreading plants in the open border, such as saxifrages, primroses, strawberries, &c., which afford a shelter for them under the cover of their leaves. When a plant of this habit is seen to languish and droop, an examination under the covering leaves will often show a family of young Onisci sheltered by them which have eaten all round the neck of the root.

They are difficult to dislodge from our hot-houses, for wherever a crevice or chink exists there they find shelter, and they even make galleries through the sphagnum and moss in which some orchids are grown. No wholesale mode of destroying them is known. They must be cut off in detail, and the same sort of contrivances which are had recourse to to entrap earwigs and surface larvæ must be used against them. Scooped-out potatoes or apples, placed like little domes, into which they can creep up, or put into pots under a little moss and little heaps of decaying plants, turfs, or pots filled with horse droppings in a half dry state (to which they are very partial), may be left in the houses at night and examined, and the creatures destroyed, every morning, and so by care and attention their numbers may be thinned; but they are so numerous and universally distributed that no complete cure can be looked for, fresh recruits constantly coming in from without. The walls of the orchard and of the houses should be carefully pointed to remove the crevices in which they hide.

CASE I. Nos. 3, 4. PORCELLIO SCABER (*Latr.*).—No. **3.** Specimens (12); **4.** Enlarged figure of ditto.

Porcellio scaber (natural size).

Antenna of Porcellio scaber.

External antennæ, seven-jointed. Rougher than Oniscus asellus, and browner and more varied in colour. There are several species, two of which have the power of rolling themselves up like a ball, the rest have not.

Nos. 5—7. ARMADILLO VULGARIS (*Linn.*).—**5.** Specimens (12); **6.** Enlarged figure of ditto; **7.** Enlarged figure of insect rolled up as a ball.

Armadillo vulgaris rolled up as a ball.

Armadillo vulgaris. (natural size).

Antenna of Armadillo vulgaris.

In this genus, as in Porcellio, the last elbow of the outer antennæ has two joints instead of three, and the insect has the power of contracting itself into a ball. It is larger, smoother, and of a more uniform slatey-blue colour than the others. Its habits, and the mischief it does, are much the same as those of the common Oniscus, and the remarks made on it also apply to this and the species of Porcellio.

CASE I.

INSECTS—Generalities.

THE general arrangement adopted in this work is the following :—

1. APTERA, or Wingless Insects (Spiders, Mites, Lice, &c.)
2. HEMIPTERA, or Bugs.
3. ORTHOPTERA (Earwigs, Cockroaches, Locusts, &c.)
4. DIPTERA, or Two-winged flies.
5. HYMENOPTERA (Bees, Wasps, &c.)
6. NEUROPTERA (Dragonflies).
7. LEPIDOPTERA (Butterflies and Moths.)
8. COLEOPTERA (Beetles).

At the commencement it may be proper to note the following generalities, for the benefit of those to whom the subject is new. Insects, in their most complete character, pass through four stages or phases of existence—the egg, the larva (maggot or caterpillar) stage, the chrysalis, and the perfect stage. In none of these, except the larval or caterpillar stage, does the insect increase in size. It is not unusual to hear people speak of a small beetle or moth being the young of a larger one that is otherwise like it, but after insects have come out of the chrysalis stage they never grow—all the growth is done in the earlier stage when they are caterpillars. If we sometimes meet with two insects of the same species but of different size, the difference is due to the supply of food which the caterpillar had during its growth, and is only a parallel case to an ill-nourished child growing up into a stunted man. Some insects, as the Aptera, pass only through three stages: the egg, the younger state, and the perfect form—and some of the intermediate orders also attain perfection without passing through more than two.

The egg is usually deposited, but in some few cases it is hatched in the body of the parent; in some others it is, at one period of the year, deposited as an egg, and at another the progeny is brought forth alive. In others again it is sometimes the one and sometimes the other. In the larval stage the insect casts its skin

CASE I. or moults several times, after each casting attaining a sudden and rapid increase of size. The larva does not always take the form of a caterpillar or maggot. In some orders (the Aptera, Hemiptera, and Orthoptera) it assumes a good deal of the appearance of the perfect insect. In this imperfect metamorphose it changes its skin as the caterpillars do, and it does not assume a different form for the chrysalis state.

In the other orders the larva, on its last change of skin, assumes a new form known as the chrysalis, or pupa, in which state it lies dormant and nearly motionless, shut up like a body in a shroud, until the last change takes place, when it comes out as the perfect insect. This chrysalis, in some cases, merely consists of the hardened skin of the animal itself, and is left unprotected and bare in the open air, or in the earth or other place of concealment, but in other cases a cocoon or case is made by the larva for it previous to and in anticipation of the change—in some spun like the cocoon of the silk-worm, in others composed of fragments of earth or bits of wood, &c., glued together.

It is to be borne in mind that in Natural History no rule or definition is of absolute and invariable application. Unexpected deviations which puzzle the naturalist and refuse to be bound by his rules, occur in every order. These must be treated as exceptions.

APTERA (Wingless Insects).

The Aptera are arranged in the four following orders, viz. :—

1. MYRIAPODA (Centipeds, &c.).
2. ARACHNOIDÆ (Spiders, Scorpions, and Mites).
3. THYSANURA (Springtails).
4. PARASITICA or ANOPLURA (Lice).

Order MYRIAPODS.

The order of Myriapods is distinguished by the mature animal being divided into numerous segments, each bearing two or four feet, terminated by a single claw. In the young state they have all fewer segments, and at first only three pairs of feet. Some

CASE I. have no eyes; but the majority are provided with two clusters of single eyes varying in number. It is divided into two great sections, the most important character of which, so far as the economic entomologist is concerned, is that the one (with two curious exceptions, the Sugentia, where the mandibles are converted into a sucking apparatus, and the Pauropoda, which are wholly aberrant), has its jaws or mandibles formed on the ordinary plan adopted in insects that bite their food, while the other has them formed out of its fore-legs into something half-leg, half-jaw, after the fashion of the falces of spiders, with a sharp point and a hollow duct up their core, which is connected with a poison gland, as in the spider. The former of these sections compose the Chilognaths (meaning jaw-jawed insects) or Diplopods, the latter the Chilopods (meaning foot-jawed insects) or Scolopendridæ. This difference in the character of their jaws is a very important one for the horticulturist, as in this instance it is a character by which he ought to be able to distinguish between his friends and his enemies. The Julidæ have their jaws perfectly adapted for biting vegetables as well as any other matter. The Scolopendridæ have not, and the same principle that enabled Cuvier to determine the nature of his fossil vertebrates, whether carnivorous or herbivorous, equally applies to the organs of feeding in these insects. Both, to be sure, are equally under the ban of horticulturists, because both are found by them in injured roots of plants, and they credit both alike with the damage done, although the one actually did it or helped to do it, and the other only came there to prey upon the insects that were busy doing it. Curtis, although himself regarding the Scolopendræ as carnivorous, mentions that the late Mr. Hope "attributed the Potato disease to the attacks of the wire-worm, and also to a small Scolopendra which he had found in myriads infesting diseased Potatoes at Southend," and Curtis adds that he himself "observed them in rotten Potatoes in August 1845; and in September 1848 Geophalus electricus was running about in every direction when the

CASE I. Potatoes were forked out." But an examination of the structure of their mouth and jaws, at once shows that the Scolopendridæ could never be vegetable feeders. There are two principles which it is safe to say Nature never deviates from. She never does anything without a purpose, and she never wastes her labour. If she endows an animal with any special structure or apparatus, it is for some end. Now it is obvious that if the centipedes feed on the roots of plants, they must sin against both of the above principles in Nature's code. A poison bag and a poison tooth can be of no possible use to a herbivorous animal; therefore, as it would be a useless waste of apparatus to give it something which was of no use to it, the animal possessing these tools cannot have been intended to be herbivorous.

Section CHILOGNATHA (*Diplopoda mare*).

Mandibles not perforated, but adapted for ordinary biting and chewing. The anterior six feet are placed one on each side of each segment, the remainder two on each.

Family JULIDÆ (commonly called Snake Millipeds).

Nos. 8, 9. GLOMERIS LIMBATA (*Linn.*).—**8.** Specimen (1); **9.** Enlarged figure of ditto.

Glomeris limbata (natural size).

It will be seen from the specimens of this species how closely the genus resembles Oniscus, and especially Armadillo, in outward appearance, notwithstanding the wide difference between a crustacean and an insect. It seems one of those transition cases of which many instances occur in nature. Its habits are similar to those of the Onisci.

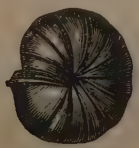
The insects with the aspect of Oniscus have been divided into two sections, according to whether the eyes (which are simple and not compound) are disposed in a curved line or in a cluster, so as to be like the compound eyes of other insects. The above belong

CASE I. to the former; the following to the latter. The species limbata is black with a narrow yellow margin.

Nos. 10, 11. SPHÆROPŒUS CASTANEUS (*Newp.*).—**10.** Specimens (3); **11.** Enlarged figure of ditto. The difference between the structure of the antennæ of the Oniscidæ and these insects is shown in the woodcut.

Nos. 12, 13. SPHÆROPŒUS HETEROSTICTUS (*Newp.*).—**12.** Specimens (1); **13.** Enlarged figure of ditto.

Nos. 14, 15. SPHÆROPŒUS GLABRATUS (*Newp. ?*).—**14.** Specimen (1); **15.** Sketch of an Orchid injured by such insects.



Sphæropœus glabratus (natural size).

Antenna of Sphæropœus castaneus.

This and the preceding species were found by a nurseryman amongst a number of plants imported by him from the East Indies.

Genus JULUS (*Linn.*).

The small thread-like Juli do not look very like the short, stumpy Glomeris; but a little examination will show that Julus is only a very long and somewhat modified Glomeris. In their youngest stage they have few segments and only three pairs of legs, which appear respectively on the second, third, and fifth segments.

Young Julus with only six legs (magnified).

Julus a little older, with 14 legs (magnified).

As they grow older, the number of segments and legs increases at each change of skin, until they reach maturity, when the number of segments may reach to fifty and upwards. As already said, the Juli or snake Millipeds are general feeders, consuming both

CASE I. decaying and living animal and vegetable substances. They prey upon slugs, small snails, insects and their larvæ and pupæ, earth-worms, &c. So far they may be regarded as friends; but, unhappily, they also feed on living vegetables, and various plants are often seriously injured by their attacking their roots. In particular they feed upon our root crops, potatoes, carrots, &c. It has been said that although often found in holes in our root crops, it may be that the holes were already there before they came, and that they have only come to feed on the soft parts of a diseased or decaying root. The truth may be that a sound healthy tuber has too tough a coat for them to penetrate, but when they get into the juicy interior of soft pulpy roots, such as bulbs, the case is different; they can have no difficulty in making their way into them or in consuming the tender fibres of the roots of herbaceous plants.

It is very doubtful whether any means have been found of getting rid of these insects. Sprinkling soot and nitrate of soda over the land and watering it with lime water have been recommended, but apparently without much success. It is difficult to damage the insect without damaging the plant it is attacking too. So far as greenhouses, hothouses, and outhouses are concerned, they may be kept tolerably free from them by care, cleanliness, and the adoption of such traps as have been already referred to; but the open fields are less under control.

Nos. 16—20. JULUS PULCHELLUS, (*Leach*), (supposed to be J. guttatus, *Fab.*). — **16.** Specimens (several in a phial); **17.** Enlarged figure of ditto; **18.** Sketch of carrot injured by ditto; **19.** Lily roots injured by ditto, preserved in glycerine; **20.** Model of lily roots injured by them.

Julus pulchellus (natural size and magnified).

This is an insect as to whose hurtful properties there can be no doubt. It is probably the most injurious of all the snake Millipeds, as it is the commonest. It is a small, long, thread-like

CASE 1. species, too minute and slender to allow anything to be done against it by direct manipulation. When viewed under a magnifying-glass it will be seen to be a very pretty little animal, like a pale thread, about the thickness of a pin, with a double row of bright crimson spots on it, and when put in spirits it stains the liquid of a purple hue, to which it itself turns after death. It has no eyes, which has led to its being regarded as belonging to another genus. This is the species which most frequently forces itself upon the attention of horticulturists, and lilies seem especially the object of its attacks.

The specimens of lily scales (No. 19) were presented to the collection by Mr. George F. Wilson, F.R.S., from plants which were entirely disintegrated by them, and a correspondent of one of our horticultural periodicals (*The Garden*) not long ago stated that on turning out some pots of Eucharis amazonica and Vallota, which were not thriving, he found, besides acari, a quantity of this species of snake milliped busy about the roots. Further investigation showed that the roots of some of the sickly plants had been perforated by these insects, which had also eaten their way into the body of the bulbs themselves. Curtis, from his own knowledge, specifies the roots of the scarlet runner, the roots of the cabbage tribe generally, and the roots of young wheat, as having been attacked, and Mr. Wilson Saunders notes that he had observed that the young roots of heart's-ease were injured by this species.

Nos. 21—23. JULUS TERRESTRIS (*Linn.*).—**21.** Specimens of ditto (1); **22.** Enlarged figure of ditto; **23.** Model of parsnip root in which they were found feeding.

Julus terrestris (natural size).

Antenna of Julus terrestris (magnified).

This does similar mischief to the last. It is one of the largest British species—reaching an inch in length—and is distinguished

CASE 1. from that which comes nearest to it (Julus Londinensis) by having rather longer antennæ and by the pre-anal segment of the tail being mucronate (terminating in a sort of spike) instead of simply rounded or nearly so.

Nos. 24, 25. JULUS LONDINENSIS (*Leach*).—**24.** Specimens (1?); **25.** Enlarged figure of ditto.

Julus Londinensis (natural size).

This is very similar to the preceding species, and differs chiefly from it in having the apex of the tail rounded, or nearly so, instead of having the pre-anal segment pointed. It has been found at the roots of wheat plants, apparently feeding upon them.

Besides the above there are several other species of Julus found in Britain, viz.: Julus pilosus, which Curtis found at cabbage roots; Julus punctatus, which is met with in moss and old woods, and probably in gardens; and Julus latistriatus, which has been found infesting a garden.

There are also many exotic species, of which one or two examples are added to the collection to give the student a better general idea of the different forms the family assumes. Thus—

Nos. 26, 27. JULUS NITENS (*Murr.* n.s.).—**26.** Specimen (1); **27.** Enlarged figure of ditto.

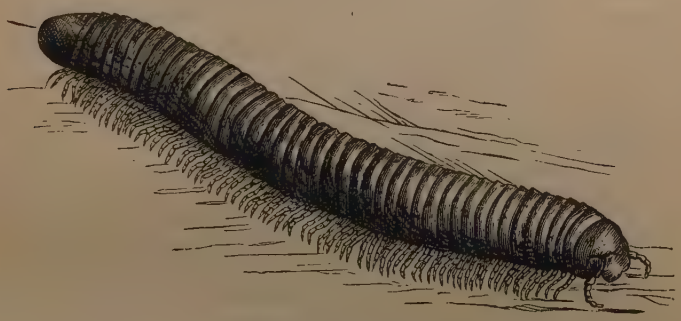
Julus nitens (natural size).

This is an exotic species found amongst a number of recently imported plants in a nurseryman's hot-houses—supposed to be from the East Indies. It is about double the length and thrice the thickness of Julus terrestris, is of the same leaden-coloured hue, but is very highly polished and shining. It has a row of dark spots all down the middle of each side, and its legs and antennæ are bright light red.

CASE I. Nos 28, 29. SPIROSTREPTUS JAVANICUS (*Br.*).—**28.** Specimens (1); **29.** Enlarged figure of ditto.

A large exotic species from Java, placed here to shew the large size to which the species reach in tropical climates, and thereby to shew the characters of the Juli more distinctly.

Nos. 30, 31. SPIROSTREPTUS ANNULATIPES (*Newp.?*).—**30.** Specimens (2); **31.** Enlarged figure of ditto.



Spirostreptus annulatipes (natural size).

This is probably a climatal variety of Newport's Spirostreptus annulatipes. That species comes from West Africa, this from Natal. The banded legs and other characters agree, but the fine rugæ on the segments spoken of by Newport are less numerous.

Genus POLYDESMUS (*Latr.*).

This genus is the transition link between the Snake Millipeds and the Centipeds. The species are flat and compressed, and the segments are usually more or less granulated or nodose on the back. The British species is small, but the exotic ones reach two inches or more in length. Their exterior is very hard and impenetrable, but the joints and limbs are very fragile and easily detached. They have the same mode of development as the Juli, the early three pair of legs, however, appearing on the second, fourth, and fifth segments, instead of on the second, third, and fifth. They have also the same habits, and like them, have been

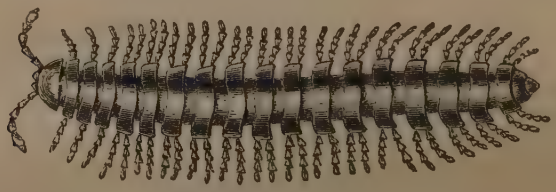
CASE I. found in numbers eating the roots of various plants. Anemones, pansies, and onions are mentioned as having been injured. The treatment indicated is the same as that for the Juli.

Nos. 32, 33. POLYDESMUS COMPLANATUS (*Linn.*).—**32.** Specimens (5); **33.** Enlarged figure.

Polydesmus complanatus (young and full grown, natural size).

In its earlier stage it is from a quarter to half an inch long, and when mature reaches nearly an inch in length. It is of a pale whitish lilac colour. It has a worse character among horticulturists than even the Juli.

Nos. 34, 35. POLYDESMUS DORSALIS, (*Murr.* n. s.) (aff. THOMSONI) (*Luc.*).—**34.** Specimens (1); **35.** Enlarged figure.



Polydesmus dorsalis (natural size).

A large tropical species two inches in length—not unlike the West African species P. Thomsoni; of similar dimensions, but the segments are almost free from granulations, and a whitish stripe runs up the middle of the back the whole length of the body.

Family SUGENTIA.

Parts about the mouth consolidated into a tubule fitted for sucking up liquid food.

Most authors have regarded this modification of the parts of the mouth as of so much importance that they have treated the species possessing it as a distinct order or family equal in value to the Chilognatha, or Chilopoda. The importance of such a modification is not the same in all orders, and the lower we go

CASE I. in the scale the less is its value. In this case, too, the insects themselves are to all outward appearance so similar to the Polydesmi that we have difficulty in separating them from that genus, and cannot accept the idea of giving them any higher rank than a family of the Chilognatha. In like manner we must proportionately reduce the value of the sections composing it. It has been divided by those who regard it as an order into the families of Polyzonidæ, with simple eyes, and Siphonophoridæ, without eyes; which again has been subdivided into the genus Siphonophora with a long rostrum, and Brachycybe with a short one; but as the reader goes along he will learn to distrust the value of modifications of the eyes as a character of any importance. Eyes in fact seem to be a sort of unessential accident that may be present or absent, large or small, few or many, without much disturbing the harmony of the relations of the rest of the creature's economy. In some cases such modifications are not even of generic value. The other characters of this section, however, are of more importance.

Genus BRACHYCYBE (*Wood*).

Head very short, much shorter than the antennæ, rostrum acute.

Nos. 36, 37. BRACHYCYBE ROSEA, (*Murr.* n.s.).—**36.** Specimens (1); **37.** Enlarged figure.

This is a very beautiful species that we found in California in rotten stumps. It is white with a rosy blush, very flat, and with the segments numerous, broad, and very short (in other species 47 in number); it reaches from a quarter to one and a half inches in length; the segments are compacted very close together, and so broad that they wholly conceal the legs below; there is a slight but handsome granulation on the back of the segments.

Brachycybe rosea (natura size and magnified).

CASE II.

Section CHILOPODA.

Mouth provided with foot jaws.

Family SCOLOPENDRIDÆ (Centipeds).

GEOPHILIDÆ.—Small, long, and narrow species, with numerous feet (40 or more). Eyes none. Antennæ with 14 joints.

No. 1. MECISTOCEPHALUS PUNCTIFRONS (*Newp.*).—**1.** Specimen (1).

This is an East Indian species, bearing considerable similarity to our own British kinds.

Nos. 2, 3. GEOPHILUS LONGICORNIS (*Leach*).—**2.** Specimens (2); **3.** Enlarged figure of ditto.

Geophilus longicornis, magnified.

This is a common species in Britain. The insect itself is like a long yellowish or whitish thread, a couple of inches or so in length, with a multitude of minute feet on each side. It moves along with an undulating and sinuous motion. It has no eyes.

The female sits upon her eggs like a snake, coiling herself round them in a little cell, which she makes for them in the ground, and according to Newport's observations never leaves them until they are hatched. The period of incubation is about a fortnight or three weeks.

CASE II. Nos. 4—6. GEOPHILUS SUBTERRANEUS.—**4.** Specimens (several in phial); **5.** Enlarged figure of ditto; **6.** Vignette illustration of its phosphorescence.

This species is one of those which have the remarkable property of occasionally (more especially in spring and autumn) secreting a phosphoric light, which seems to exude from the body, and is left like a shining trail on the spots over which the insect has passed. It soon fades and disappears, seldom being seen for a longer space than a couple of feet behind the insect. This is the species whose luminosity has been most frequently observed in Britain, but there are reasons for believing that the property is common to all the section of centipedes known as Geophilidæ, and that it is evolved only at the breeding season. Mr. Newport mentions having found two individuals of this species on the ground in contact with each other at midnight, on the 25th of September, which shone almost as brightly as the glow-worm, for which, at the instant, he mistook them. On taking them into his hand the luminous matter was exuded and adhered to his fingers, and continued to shine for some time, like phosphorus. The individuals appeared to be able to give it forth at pleasure. This property appears to be common to some tropical, as well as European, Geophili. Oviedo, the friend and companion of Columbus, as quoted by Newport, mentions it in his account of the island of St. Domingo:—"There are in this island (St. Domingo) many kinds of Scolopendra or hundred legs; some are slender, and as long as one's finger, and like to those of Spain, and these bite and cause considerable pain. There are others of these worms about half the length of the finger and slender, with many feet, and these shine much by night, and leave a light where they go, and may be seen 50 or even 100 feet off. Yet the whole animal does not shine, but only the joints where the legs spring from the body, and the light is very bright." From this property this species, or the G. longicornis (it is doubtful which he meant) was named by Linnæus, Scolopendra electrica.

Numerous observations are recorded of Myriapods of this

CASE II. section, after having caused lingering headache, having been sneezed forth by men from the nose. As Van der Hoeven says, it is easier to reject these observations than to explain the continued life of these insects in such an unusual situation.

Scolopendra morsitans (natural size).

Genus SCOLOPENDRA.

Eyes, four on both sides. Feet, almost always twenty-one. Antennæ with from seventeen to twenty joints.

This genus consists chiefly of large exotic species, which can inflict a painful and poisonous bite with their powerful nippers. The structure of the poison apparatus has been perfectly well ascertained, and the poisonous character of the secretion sufficiently proved by experience. As to the latter, the larger the species naturally the more powerful should the poison be expected to be, and the bite from one of them causes pain and suffering, even to man himself. Brown, in his "History of Jamaica," says of one of the larger species (S. morsitans)—"This insect is reckoned very venomous; the prongs of the forceps are very strong, bending and pointed, which enable them to bite very hard, and they probably emit some venomous juice also, as some who have been bit by them informed me that the part bitten is very painful for two or three hours, and turns frequently of a livid colour. I have seen them often kill

CASE II. a cockroach with a single nip." Another example of the severity of the bite came within our own personal knowledge. The sufferer was the manager of a sugar plantation in Jamaica in the bygone days, when there were still slaves, and Jamaica was still Jamaica; and in the "boiling season," when the juice of the cane is boiled to produce the sugar, it was his duty or practice to visit the boilers during the night to see that the fires were kept up and no intermission allowed in the process. On these occasions he merely threw on a dressing-gown and thrust his naked feet into slippers while he took a hasty round through the works. While thus engaged he was once bitten on the leg a little above the ankle by one of these large centipeds. They are nocturnal animals, and of course most lively and alert at night. He described the pain as so excruciating that he almost fainted on the spot, and had to be assisted into the house. As to the structure of the apparatus for poisoning the wound made by the bite, that was satisfactorily made out by Mr. Newport, the eminent entomologist, whose loss is still deplored by our older naturalists. Until he worked it out, the gland by which the poison of the centiped is secreted had not been shown. Leewenhoek discovered at the apex of the mandibles an orifice that communicated internally with an elongated cavity, and he also saw a drop of fluid exude from the orifice, but he did not discover the true secreting gland—which, however, Newport did. He not only confirmed Leewenhoek's observation in regard to the existence of a longitudinal opening at the inner margin of the apex of the mandible, but also traced it backwards to a sac with which it communicates, and discovered the gland of which it is the reservoir. It is to be observed, that the effect of the bite of a centiped in warm climates is very various; sometimes excessively virulent and painful, at others causing little inconvenience. It is, no doubt, in a great measure due to the state of health and constitution of the individual sufferer and his consequent susceptibility to disease; but, moreover, from experiments on venomous snakes, we now well know that the virulence of the

CASE II. poison, and the degree of injury inflicted by it, may depend much on the circumstance, whether or not the animal has recently bitten and expended its venom on some other object, in which case, the injury occasioned is less severe; and, the reason is obvious, for not only may the reservoir of venom be exhausted, but it may also be satisfactorily accounted for by what we now know of the manner in which the secretions of all glands are elaborated, viz., by the growth, bursting, and diffluence of successive series of epithelial cells that line the interior of these organs, the fluid contained within, and into which these cells and their nucleoli are resolved being the proper secretion. When this is expended too frequently, and the organ in consequence is excited by what may be called the stimulus of want, the secreting epithelial cells are hastened in their development, and the fluid into which they are resolved is imperfectly elaborated and its properties are doubtless less active.

No. 7. SCOLOPENDRA CEYLONENSIS (*Newport?*).—**7.** Specimens (2).

This is one of the larger Centipeds above spoken of. They are probably all to be equally avoided. It is from Ceylon.

No. 8. SCOLOPENDRA PLATYPOIDES (*Newp.*).—**8.** Specimens (2).

Another large and hurtful species. It is from Brazil.

No. 9. SCOLOPENDRA PLACEÆ (*Newp.*).—**9.** Specimens (2).
From Brazil.

No. 10. SCOLOPENDRA VARIEGATA (*Newp.*).—**10.** Specimens (2).
A handsome species from Brazil.

Scolopendra variegata (natural size).

CASE II. No. 11. SCOLOPENDRA ANGUSTICOLLIS (*Murr.* n.s.)—**11.** Specimens (2). From Old Calabar.

A strong, stout, largish species, of an olivaceous colour and smooth, shining texture; length about 4 inches; very similar to some of the Australian species, such as S. sulcidens,—a curious resemblance which has been observed in other species of this family from these far-separated lands. Denticulations of labium small. Antennæ 17-jointed. Body of 22 segments, including the cephalic segments. The scutes at the neck are short and narrow; those that are farther back gradually become broader. The third segment (that immediately behind the cephalic), the fifth and the seventh, are shorter than those between them. The teeth on the femoral joint of the terminal legs are on the inner side, one rather large one at the posterior angle; then three small ones nearer the body, and a lower row of three other small ones; on the outer side three in a lower row.

No. 12. SCOLOPENDRA LEACHII (*Newp.*).—**12.** Specimen (1). From the Cape Verde Islands.

No. 13. SCOLOPENDRA TUBERCULIDENS (*Newp.*).—**13.** Specimens (2).

This species derives its name from the tooth on the inner angle of the thigh of the last legs, being composed of five smaller teeth. It is from the East Indies.

Nos. 14, 15. SCOLOPENDRA CŒRULEO-VIRIDIS (*Murr.* n.s.).—**14.** Specimens (2); **15.** Enlarged figure of ditto. From New Holland.

This is one of the middle-sized species, about $2\frac{1}{2}$ to 3 inches long; of a rich bluish green, with head and terminal feet orange-red. Antennæ 17-jointed, of a lovely turquoise green, and legs of a pale semi-transparent light green. Body of 22 joints. Terminal legs rather compressed and tumid, and with a tooth at the inner angle of the femoral joint, two small ones in a row farther back, two more in a lower row, and two again below them. In

CASE II. small and not full-grown specimens these teeth are absent, or only showing indications. This was presented to the collection as giving a very venomous bite. It does not appear to have been hitherto described.

Genus CRYPTOPS (*Leach*). No eyes.

Nos. 16, 17. CRYPTOPS HORTENSIS (*Leach*).—**16.** Specimen (1); **17.** Enlarged figure of ditto.

Cryptops hortensis (slightly enlarged).

This is one of our British species. It is yellowish brown in colour; has no eyes; 21 pair of feet; and antennæ with 17 joints.

Genus LITHOBIUS (*Leach*).

Nos. 18, 19. LITHOBIUS FORFICATUS (*Linn.*).—**18.** Specimens (4); **19.** Enlarged figure ot ditto.

Head of Lithobius forficatus.

Lithobius forficatus (natural size).

Antennæ with numerous joints tapering to the tip; in adults above forty. Fifteen pair of feet and two groups of eyes in the external margin of the head behind the antennæ. It is about an inch in length, and broader than any other British species.

CASE II. De Geer practically watched the proceedings of this species, and says of it, "I have seen a fly after being bitten by one of the Scolopendræ die almost instantaneously, which would seem to indicate that their bite is venomous." The jaws may be seen in the enlarged woodcut of the head of this species.

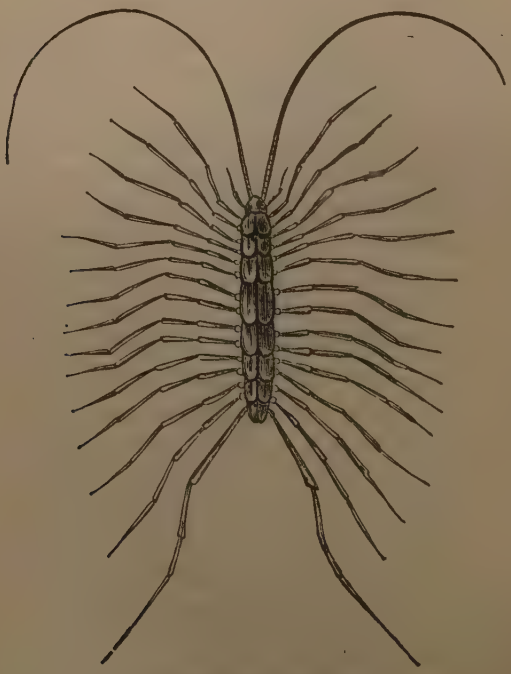
Genus Cermatia (*Meg.*).

The genus Cermatia, or Scutigera as it was called by Lamarck, is distinguished from all the rest of the Myriapods by its long legs, bringing it, in this respect, near to the spiders, which it resembles also in its very rapacious and carnivorous nature. The eyes are two, compound. One pattern of colouration runs through the whole of the Cermatiæ, viz., longitudinal stripes on the body and annulations on the appendages. The colour varies in different species, and although very evanescent after death or when exposed to alcohol, is probably a good specific character. Mr. Wood mentions that he has seen specimens of one of the North American species, C. forceps (which is greenish brown with longitudinal stripes of dark green), changed almost immediately to green or blue, or, still more commonly, to bright purple by alcohol. The legs in all the species are banded. They are also very easily detached, it being almost impossible to preserve a specimen without losing them, which prevents the use being made of the relative proportions of their parts which might otherwise be done. In one respect the Cermatidæ seem to form an exception to a character which is universal in the family in which it is placed; but it is only apparent, not real. The head in the Chilognaths is composed of only one segment; but in the Chilopods, to which Cermatia belongs, it is always developed into two separate segments, the posterior of which gives origin to the immense foot jaws of the family. In apparent contradiction to this, the head of the Cermatidæ, when viewed from above, appears to consist of but a single segment; but this is merely because the two

CASE II. cephalic scuta are fused together and consolidated, just as two body scuta are, to form one segment. The sternum of the posterior segment is entirely separate, and leaves the foot jaws as in other families. It was from observations on one of this genus (Scutigera araneoides) in the south of France that Latreille satisfied himself of the poisonous nature of the bite of this family.

Nos. 20, 21. CERMATIA CAPENSIS (*Westw.*).—**20.** Specimens (1); **21.** Enlarged figure. From the Cape of Good Hope.

Nos. 22, 23. CERMATIA SMITHII (*Newport*).—**22.** Specimens (1); **23.** Enlarged figure. From New Holland.



Cermatia Smithii (natural size).

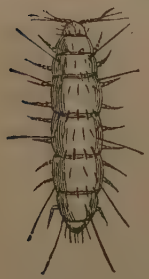
CASE II.

Section PAUROPODA.

The little creature which alone composes this section can be brought neither into the ranks of the Chilognaths nor into those of the Chilopods; and there seems no help for it but to make a separate section to receive it. It certainly is a very insignificant object to be entitled to so much honour. It is a semitransparent little animal, only the twentieth of an inch in length, and with much more of the appearance of the Thysanura (among whom and in whose haunts it lives) than of a Myriapod; and only one species of it seems yet to have been found. Sir John Lubbock, to whose researches we owe our knowledge of the creature at all, indeed describes *two* species, and gives, as the only character that he could find, some difference in the antennæ. He thinks that he has found both sexes in one of his species; at least, in some that had organs, which he was unable to trace in all, he found spermatozoa, and these consequently must have been males, although it does not absolutely follow that the rest were not. If he is right in this, the present will be the first case that we can call to mind of the antennæ differing materially in species of the same genus. It is a very common thing for them to differ in the sexes of the same species; but the generic character, as a rule, subsists through all the species of the same genus. This tiny and solitary species, although it looks so like the Thysanura, cannot go with them; for although it has only six feet in the earlier stage of its life, it ends by having eighteen (9 pairs). Now, as Mr. Wood, the American myriapodist, has well put it, when a spider, an insect, a Thysanura, or a Crustacean, leaves the egg, its body has its maximum number of segments, and development takes place by the coalescence and disappearance of some of these. The embryonic Myriapod, on the contrary, has its minimum number of segments, and develops by their increase; so that while the adult insect has generally fewer, never more segments than the young, the adult Myriapod may have eight times as many, and never fewer than

CASE II. its young. Tried by this test, the Pauropus must be a Myriapod; but it cannot be a Chilopod, because it has no foot jaws, but feeble mandibles. It is apparently a herbivorous, not a carnivorous Myriapod, and has a better right otherways to be placed among the herbivorous Chilognaths; but although it at first sight appears to have two legs to each segment in the middle of the body, still they are not placed together as in the Julidæ, and the difference of the antennæ is very great. The latter partake more of the crustacean character than those of any insect that we are acquainted with. It has ten segments, the first two of which compose the head, or if they be reckoned from the under side, counting a segment for each pair of legs, there would appear from Sir John's cut to be 13, the same number that is possessed by true hexapod insects. It has also 18 legs, the smallest number in any species yet described being 26. For other details we must refer to Sir John Lubbock's paper.

PAUROPUS HUXLEYI (*Lubbock*), Trans. Linn. Soc., vol. 26.



Pauropus Huxleyi (magnified).

A bustling, active, neat, and cleanly little creature, living throughout the year in considerable numbers among dead leaves and other decaying vegetable matter in company with the various species of Thysanura, mites, &c., that frequent similar situations: found throughout the winter on the warmer days, about half a line in length.

PAUROPUS PEDUNCULATUS (*Lubbock*), loc. cit.

Perhaps the female of the above. It cannot be the male, for it was in the other that Sir John Lubbock found spermatozoa.

CASE III.

Order ARACHNOIDEA.

(SCORPIONS, SPIDERS, AND MITES.)

THE system of classification which is adopted for the chief part of this collection, viz. that of beginning with the lower orders and advancing to the higher, has been departed from in the spiders; first, for the sake of making a natural connection with other orders, and second, for reasons special to Economic Entomology, such as keeping together as much as possible those species that attack a common class of objects, and separating those that attack a different class.

In the present case (the arachnoids), the arrangement has been made from above downwards, commencing with the scorpions and terminating with the mites, instead of the reverse; this brings the mites into closer connection with the lice, with which it will be found that they have certain points of analogy if not of affinity.

The arachnoids are generally considered by zoologists as a group apart, belonging neither to the crustaceans nor the insects. Like crustaceans, spiders possess the property of reproducing such limbs as have been detached or mutilated; and this curious physiological phenomenon is intimately connected with the casting of their skin, for legs, palpi, and spinners, which have been amputated, are observed to be restored, and afterwards to have their dimensions enlarged, at the period of moulting only; but there are much more important grounds for removing them from the crustaceans and classifying them with insects. For example, the crustaceans breathe by gills, the spiders do not. The separation of the spiders from insects is not nearly so well marked. Insects breathe by tracheæ, that is, air-tubes opening on each side of the segments of the abdomen. Spiders breathe by something called pulmonary sacs, which are placed at the base of the abdomen. But not only are these pulmonary sacs (although fewer than

CASE III. the tracheæ) placed in the abdomen as in insects, and not only are they in many respects analogous to the tracheæ, but in some spiders they are supplemented by one or two tracheæ. Again, one distinction between insects and spiders is, that the former have never more than three pairs of legs, while the spiders have four pairs; but the first pair in the spiders are only modifications of the palpi. Again, insects are divided into three parts, head, thorax, and abdomen. Spiders consist of only two or one part, as in some mites; but all this is a mere modification of parts. The head of the spider is merged in its thorax, so that no line of separation can be drawn, but we know that the front belongs to the head, and the back part to the thorax, by the organs which they respectively bear. The mouth and its parts (along with the anterior legs) in the one case, and the rest of the limbs in the other case. It seems to us, therefore, that the arachnoids are to be regarded as modified insects.

Family SCORPIONIDÆ or PEDIPALPS (Scorpions and their allies).

Anterior palpi elongated like legs, and provided with nippers like the claws of a crab.

Sub-Family, PSEUDO-SCORPIONES (False Scorpions).

The cephalothorax is united to the abdomen, which is divided into segments. No tail.

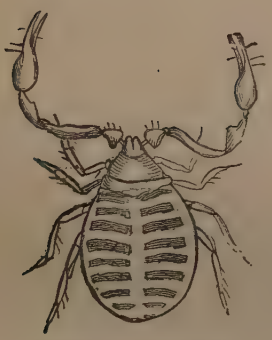
Genus CHELIFER (*Lat.*).

Cephalothorax parted in two by a transverse furrow.

Nos. 1, 2. CHELIFER MUSEORUM (*Fab.*).—1. Specimens (8); 2. Enlarged figure.

The chelifers are harmless minute insects, like scorpions in appearance, but which, although possessing their nippers, are destitute of the armed tail; as in this species, the fore-legs (palpi) are sometimes very long. They live in dark and moist places,

CASE III. and feed on mites and wood-lice. The present species has received its name from being often found in neglected books and museums. Found in Britain and throughout Europe.



Chelifer museorum (magnified.)

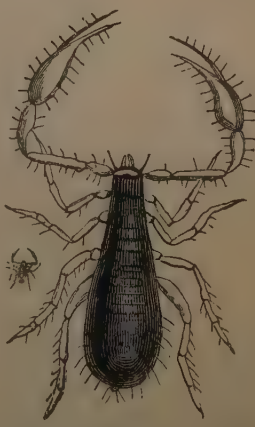
Chelifer cancroides (magnified and natural size).

CHELIFER CANCROIDES (*Koch*).

Found throughout Europe.

Nos. 3, 4. CHELIFER GEOFFROYI (*Koch*).—**3.** Specimens (3); **4.** Enlarged figure.

Another British species, but with less elongated anterior legs.



Obisium carcinoides (magnified and natural size).

Genus OBISIUM (*Illig.*).

Cephalothorax not divided by a transverse furrow.

OBISIUM CARCINOIDES (*Herm*).

Found in Germany and other parts of Europe.

CASE III.

Sub-family SCORPIONES (True Scorpions).

THE characters of the family are two large ocelli, placed close together in the middle of the cephalothorax, smaller lateral ocelli, various in number, distributed along its anterior margin, and the six last joints of the abdomen narrowed into a tail terminating in a sting. They have also two curious comb-shaped appendages on the under side at the base (anterior part) of the abdomen, the use of which is doubtful.

They live in tropical regions in all parts of the world, extending their range more or less into the warmer districts of the temperate zones. Their sting is not barbed, but its point is perforated, and it wounds simply by penetrating the skin, and conveying poison into the wound through two orifices from a poison bag. The poison is said sometimes to be as white as milk. Although the scorpion is much dreaded, and widely renowned for its sting, there is no doubt that its injurious effects are much exaggerated. According to Kirby and Spence the only means of saving the lives of our soldiers who were stung by them in Egypt was amputation; and they add that one species was said to occasion madness, and that the black scorpion, both of South America (Query South *Africa*, *Buthus afer*,) and Ceylon, frequently inflicts a mortal wound. All this is very doubtful, but it may be true that, as is stated on good authority, the sting of certain kinds common in South America causes fevers, numbness in various parts of the body, tumours in the tongue, and dimness of sight, which symptoms last from twenty-four to forty-eight hours. It is curious, however, that the only approach to personal authentic information on the subject which Kirby and Spence had, is against the sting being so hurtful. Mr. W. S. MacLeay told them that soon after his arrival at Havana he was stung by an immense scorpion, but was agreeably surprised to find the pain considerably less than that of the sting of a wasp, and of incomparably shorter duration.

CASE III.

In their native countries the natives do not seem to dread them. Dr. Leared informs us that at Morocco he saw men take them up in their hands and make them run along their naked arm, turning them back as they came to the edge and threatened to topple over.

They do not lay eggs, but are viviparous. They are, however, most unnatural parents, for they devour their offspring as soon as they are born.

Mr. Riley, the State entomologist of Missouri, says of the American species, that the boys sometimes call them teetotallers, from the fact that they cannot endure alcohol; and that a drop of whisky deposited upon one of them will cause it to immediately commit suicide by stinging itself to death.

They have been divided into a number of sections, according

Buthus afer (natural size, small specimen).

to the number and position of eyes on the head. The big black species, with thick, heavy, hard claws constitute the genus Buthus.

CASE III. Some of the narrow yellow species, with slender long pincers, form the genus Androctonus, signifying in Greek "Man-killer," and other genera, Ischnurus, Brotheas, Opistophthalmus, Væjovis, &c., have been established on the shape of the cephalothorax, the number and position of the eyes, the characters of the tail (as square, or round, &c.), and the form of the back.

Væjovis, sp. (natural size).

Nos. 5, 6. ANDROCTONUS (*Sp.*), from Rangoon.—**5.** Newly-born specimens (3); **6.** Enlarged figure of do.

No. 7. ANDROCTONUS PRIAMUS (*Koch*) (?), from Java.—**7.** Specimens of do.

No. 8. ANDROCTONUS (*Sp.*), from East Indies.—**8.** Specimen of do. (1).

No. 9. BUTHUS (*Sp.*) from the Cape.—**9.** Specimens of do. (2).

This probably should form another genus.

No. 10. BUTHUS CÆSAR (*Koch*), from the East Indies.—**10.** Specimens of do. (2).

No. 11. BUTHUS AFER (*Koch*), from East Indies.—**11.** Specimen of do. (1).

No. 12. BUTHUS IMPERATOR (*Koch*).—**12.** Figure natural size, copied from Koch's Araneidæ.

This is the largest species we have seen described. It is at least six inches in length; but it seems nothing but an unusually large immature specimen of B. afer.

CASE III.

Sub-Family PHRYNIDÆ.

Abdomen separated from thorax by a slight constriction. Tail either absent or unprovided with a sting.

Nos. 13, 14. PHRYNUS CEYLONICUS (*Koch*).—**13.** Specimen (1); **14.** Figure (natural size). From Ceylon.

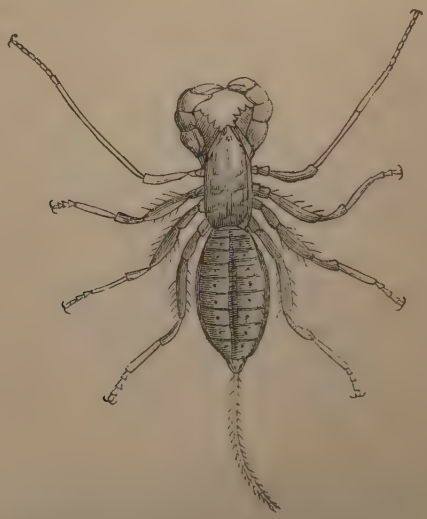
We have placed this and some of the following species here, not as being either hurtful or beneficial to man, but as showing the passage between the Scorpions and the Spiders; and as Phrynus ceylonicus is too large for our page, we give a figure of a smaller species, Phrynus palmatus.

Phrynus palmatus (natural size).

Nos. 15, 16. TELYPHONUS GIGANTEUS (*Koch*).—**15.** Specimen; **16.** Figure of natural size. From the East Indian region.

The tail in this genus is in the form of a jointed bristle, but unarmed.

CASE III. Nos. 17, 18. TELYPHONUS PROSCORPIO (*Koch*).—**17.** Specimens (2); **18.** Figure of do., natural size. Another species from Java.



Telyphonus proscorpio (small specimen, natural size).

Family SOLPUGIDÆ.

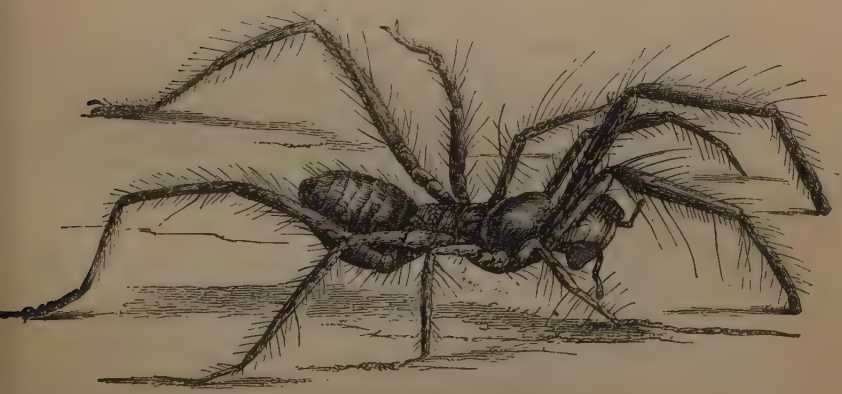
Cephalothorax distinct from abdomen, which is segmented. No tail. Has the aspect of a spider.

Nos. 19, 20. GALEODES ARANEOIDES (*Pall.*).—**19.** Specimen (o); **20.** Figure of do. slightly magnified; **21.** Illustrative vignette—camel.

This is a large spider-like animal, which reaches nearly two inches in length, and has a pale thorax and legs, and dark abdomen. It is easily distinguished from the spiders by its abdomen being segmented, as well as by having a different kind of breathing apparatus, viz.: tracheæ instead of pulmonary sacs.

The genus is chiefly found in the Old World, and for the most part in Africa and the borders of the Mediterranean, but species have also been found in the New World. They live in sandy

CASE II. deserts, and their bite is said to be venomous, and even dangerous, but proof is wanted of this. There seems to be no doubt, however, that they are a great torment to the camels in the countries where they abound, and from the formidable nature of their mandibles, and the ready ferocity with which they present them for attack when interfered with, they have obviously both the will and the power to inflict a severe bite, whether any poison is instilled into it or not. They feed upon other insects, particularly a kind of Acridium (grasshopper), of which they are fond. They dig great



Galeodes araneoides (natural size).

galleries or pits in the sandy soil, removing the *débris* to a distance by means of their mandibles, and using the stiff hairs which accompany them as a sort of broom to sweep them away. The present species has been found in the South of Russia and Greece, but its chief range is further south, extending from Egypt and one or more of the oases in the desert, to India, where it is common and troublesome. It there reaches a large size, its body being sometimes two inches long without its legs, or with them ten inches.

It is seldom seen except by night, and runs with great rapidity, more like a mouse than a spider, but covering much more space.

CASE III. The Rev. J. J. Wood, in his Natural History Illustrated, mentions the following particulars regarding this insect, which were communicated to him by Lieut.-Gen. Sir J. Hearsey :—

"When the Galeodes approaches any creature that it desires to attack, it thrusts out its long palpi, touches the body with the rounded tips of those members, and immediately raises them aloft, as if fearful lest they should be injured. The whole action is wonderfully like the manner in which an elephant flings its proboscis in the air after touching anything of which it is not quite sure. The tips of the palpi are rounded and soft, and when they are applied to any object, a sort of phosphorescent flame seems to be emitted from them. Having satisfied itself by the touch, the creature rushes in at once to the attack.

"In order to ascertain whether the Galeodes would really attack and eat vertebrated animals, an ordinarily-sized specimen was captured and placed under a bell-glass. A very young musk-rat was then inserted under the glass, the Galeodes being on the opposite side. As the creature traversed its transparent prison it came suddenly on the young musk-rat, which was quite a baby and could not open its eyes. Without hesitation it sprang on the little animal, killed it, and in a short time had eaten it.

"The manner in which the Galeodes kills its prey is really remarkable. The double set of pincers are sharply hooked, like the beak of an eagle, and are capable of being separately opened and shut like lobsters' claws, and of being used conjointly to secure prey between them ; and, moreover, the upper joint of each claw can be pushed far over the lower. When the creature seizes a large animal, such as the musk-rat above mentioned, it buries the pincers in the flesh, and deliberately shears its way onwards, each pair of pincers working alternately, one pair being engaged in holding the prey and the other in cutting.

"The same Galeodes was then pitted against a little bat, about three or four inches across the wings. Though small, it was full-grown and lively. When placed under the glass shade it fluttered

CASE III. about, but was speedily arrested by the spider, which leaped upon it, proceeded to drive its fangs into the neck, and clung so tightly that it could not be shaken off. In vain did the bat try to beat off the enemy with its wings, or to rid itself of the foe by flying in the air. Nothing could shake off the Galeodes; the long legs clung tightly to the victim, the cruel fangs were buried deeper and deeper into its flesh, the struggles gradually became weaker, until the point of a fang touched a vital spot, and the poor bat fell lifeless from the grasp of its destroyer.

"The next antagonist of this redoubtable warrior was a scorpion about four inches in length. The Galeodes seemed nothing daunted, seized the scorpion by the root of the tail, just where it could not be touched by the sting, sawed its way through the tail, severed that deadly weapon from the body, and then killed and ate the scorpion, together with its tail.

"There was, however, much uncertainty as to its mode of attack in this instance, for no one could exactly ascertain whether it was directed to the one point of safety by chance or instinct. Another similar scorpion was then procured and placed in the glass bell. The Galeodes darted as usual to the attack, but unfortunately seized its foe by the front. The scorpion immediately grasped the Galeodes in its nippers, quickly brought its tail over its back, and by a well-directed stroke succeeded in stinging its enemy. At the moment of receiving the stroke, the Galeodes started back, opened all its limbs, began to quiver throughout its whole frame, and rolled over quite dead."

Family ARANEIDÆ (Spiders).

CASE IV. THE spiders come strictly within the limits of Economic Entomology as beneficial insects. They are among the most powerful insect-friends of man, and they contribute more perhaps than any other family to check the too rapid multiplication of insects. They derive their chief sustenance from them, securing them in various ways, some by pure hunting and speed, others by watching

CASE IV. in corners and out of the way holes, but a large proportion by forming the webs for which the family is best known. Their voracity is extreme, and the numbers they consume are consequently very great; a quality, however, which is sometimes directed against themselves, for they make no exception in their search for food, often devouring one another, the weaker falling a prey to the stronger; and as the females are, with few exceptions, larger and stronger than the males, a courtship among the spiders is a service by no means unattended with danger. Like other carnivorous animals whose prey is precarious, and like the venomous snake, which lies in wait for its prey, and must often have a long and weary vigil before it comes, the spider, although so voracious, is capable of long abstinence from food. Mr. Blackwall notices the case of a female Theridion quadri-punctatum, which still survived after being eighteen months without food corked up in a phial, a period exceeding the usual natural duration of most spiders' lives, which is said to be about twelve months; some, however, have a longer time, individuals having been known to live four years.

All spiders at present known have either two, six, or eight smooth eyes, which vary much in size and relative position, supplying characters which have been much used in the systematic arrangement of species. The falces or modified mandibles or jaws with which the spider seizes its prey are inserted immediately under the anterior margin of the cephalo-thorax, and have usually at the extremity of their inner surface a longitudinal groove, provided with sharp teeth on the sides, which receives the fang when in a state of repose. The fang, or last joint of the falcis, is very hard, curved, acute, and has a small fissure near the point, which emits a colourless, more or less venomous, fluid secreted by a gland.

The palpi occupy the same place and relations as in other insects, but they are distinguished by those of the male being swollen at the extremity into a curiously twisted, variously formed organ. Those of the females remain simple. In most other

CASE IV. respects, the general form and structure of spiders is that of insects. There is one important peculiarity however, viz., the spinnerets by which they spin the webs, which are the most distinguishing and remarkable feature of the family.

The spinnerets are placed at the tail end of the abdomen, and consist of two, three, or four pairs, according to the kind of spider. They vary also in form, being round, cylindrical, or conical, and their tips and under surface are pierced with numerous minute holes, like the rose of a watering-pot, through which the liquid that becomes the thread is pumped out. It is a liquid glue, and each jet of it comes out as a thread of infinitesimal tenuity; and the whole multitude of fine threads is compacted together into a single line of extreme fineness, but great comparative strength. That this is so may be easily proved by taking any of the large spinning spiders, say one of the diadem spiders (Epeira diademata), and after pressing its abdomen against a leaf or other substance so as to attach the threads to its surface—the same preliminary step that the spider adopts in spinning—drawing it gradually to a small distance. It can then be plainly perceived that the proper thread of the spider is formed of four smaller threads, and these again of threads so fine and numerous that there cannot be fewer than a thousand issue from each spinner. The glue is a viscid fluid, which is secreted by glands in the abdomen, and is conducted to the spinneret orifices by tubes; when exposed to the air—and it is very probably for the purpose of exposing it all instantaneously that it is made to issue in such fine threads—it hardens into a most elastic silk, so elastic that its apparent rapid lengthening or shortening has given rise to the erroneous belief that the spider can retract it into its abdomen. This it cannot do; after it has once come out and hardened, there it remains. But there must either be more than one kind of glue or silk secreted, or else the one kind must be capable of modification by the animal in its passage out, for while the spider's thread itself becomes immediately hard and unadhesive,

CASE IV. it is studded all over with minute globules, which do not immediately dry up, and remain viscid to the touch; and it is by means of this sort of bird-lime that its prey is detained and attached, until the spider has time to spring upon it from its ambush. This viscid gum is not distributed over all parts of the web alike. That would interfere with the spider's own freedom of motion. It therefore forms the main radii or stays of the web of threads free from this gum, and on these it runs freely, while the prey, ignorant of these safe bridges or gangways, flounders hopelessly in the net itself. It is probable that the glue that forms the viscid globules is supplied by different tubes from the kind that hardens, and that the tubes of both kinds are intermingled, so that as the threads are forced out they come in contact with this viscid secretion, which runs together in globules through the elasticity of the thread, drawing it out more than it can bear without division.

The silken threads of which the webs are thus made are used by many species belonging to various genera for other purposes besides catching their prey—one is to enable them to take aerial excursions. Some have thought that the creatures could dart out their threads from their spinnerets to such a distance as to use them like rafts to float on in the atmosphere. That they do float through the air so supported is true—but not by darting out the threads. Experiments have proved that it is the rarefied air of fine weather that wafts the thread away from the spider, and that it only avails itself of their support to take the journey. Such threads, or webs, broken from their moorings, compose the filmy webs named gossamer, which, on being brought into contact by the breath of gentle airs, adhere together until, by continual additions, they accumulate into irregular white flakes of surprising quantity.

Efforts have been made to turn the spinning powers of spiders and the silk they secrete to practical purposes, but without much success. In the beginning of the last century an ingenious

CASE IV. Frenchman, M. Bon of Languedoc, succeeded in manufacturing some stockings and gloves of spider silk. The silk was grey, and was said to look well, but not to be equal in lustre or so durable as silk from the silkworm. M. Bon did not attempt to wind the silk, but passed it through the carding machine (treating it like shoddy or broken cocoons). He published an account of his discovery or manufacture, and the Royal Academy of Paris appointed Reaumur to report upon it. His report was not favourable; the thread of the spider was eighteen times weaker than that of the silkworm, and it was found extremely difficult to obtain it in sufficient quantity to operate on. It was calculated that 27,648 female spiders were required to make a pound weight of silk, for it appears to have been only the silk bags containing the eggs that were used, and, owing to the natural ferocity and voracity of the spider, it was found impracticable to get the silk in sufficient quantity. It seems that some thousands of spiders were placed together in cells containing from fifty to two hundred each, but these were soon reduced to one or two in each, the rest having been all killed and eaten by the survivor, who, if the fittest in one sense, was at any rate not the fittest for the manufacturer's purpose. A similar manufacture is mentioned by Mr. Blackwall as having been tried by Mr. Tremeyer, a Spaniard, also without practical success. It should be mentioned, however, that D'Azara in his Voyage dans l'Americ, (quoted by Kirby and Spence), states that in Paraguay a spider, which is found near the thirtieth degree of South latitude, forms a spherical cocoon for its eggs, an inch in diameter, of a yellow silk, which the inhabitants spin on account of the permanence of the colour.

Some specimens of M. Bon's manufacture, or of that of some one else, are said to be still in existence; and we should have liked to illustrate our cases by a specimen. Not knowing, however, where to get one we made an attempt to get samples spun and woven for ourselves, but without success. A quantity of webs was collected and washed, with the intention of being carded

CASE IV. and spun, as was done by M. Bon. But we never got the length of carding. Our difficulty was not in carding them or spinning them thereafter, which we believe can be perfectly well done, but in cleaning them for carding. The webs collected were full of impurities, straws, chaff, dirt, portions of insects, &c.; and the process adopted for cleaning waste silk did not answer for the webs. The process for getting rid of extraneous matter in the broken cocoons of the silkworm is boiling, but in the boiling, the spiders' webs boiled all away to nothing.

Another economic use of the spider's web, is the use of the strongest thread (the one that bears the web) by astronomers and microscopists for the divisions of the micrometer attached to their telescopes and microscopes; the thread is drawn in parallel lines and at right angles across the field of the eye-piece at equal distances, so as to make a multitude of cross square divisions scarcely visible to the naked eye and so fine as to be no obstacle to the view of the object.

Among other merits, both spiders and their webs have been supposed to be possessed of certain valuable medical properties, for an account of some of which see Dr. Watson's lectures on the principles and practice of physic, where he treats of ague and intermittent fevers. To this day in some parts of the West of England, notably the low lying districts bordering the mouth of the Severn where fever and ague still maintain themselves, a spider's web rolled up into a bolus and swallowed is still held to be a sovereign specific for these diseases. Even yet in some countries they have not been wholly expelled from the regular practitioner's pharmacopœia. We have seen a work on Leprosy (Mal de San Lazaro), published so lately as 1852, in Mexico, by Dr. Rafael Lucio, and another medical man, the one the professor of medicine, and the other of surgery in the university there, and in that work the authors recommend pounded Mygales (as per prescription) as a medicine for that disease, which is common in some parts of that country, and

CASE IV. for which there is a special hospital in the city of Mexico, of which these two professors had charge; the said medicine being sanctioned by the authority of their experience in the hospital. Leprosy there, for there are other forms of it elsewhere, is a disease of the inner coats of the arteries, which produces obstruction in the circulation and suppression of perspiration. They considered that this indicated the exhibition of sudorifics, and tincture of tarantula (mygale), and sarsaparilla were the sudorifics they adopted. The medicine is given either as an alcoholic tincture, or one of ether. If alcoholic, it is compound of twelve ounces of alcohol to one of tarantula (*i.e.* mygale), the tarantula powder having been made by pounding up the spiders, and after washing the powder in strong spirits of wine, macerating it for fifteen days in the alcohol, and then filtering it. In the ether tincture, sulphuric ether is substituted for alcohol, and it is then treated in the same way; an ointment and lotion are in like manner prepared from it. The dose varies, but four drops of the tincture is stated to produce powerful sudorific effects, although he adds, that it sometimes operates in a few minutes, and in other cases not until after many hours. But the concurrent effect of various symptoms and cases enumerated by him, is to show that the tincture does produce the desired effect, if not in all cases, at least in the great majority. But there remains the question whether it is due to the supposed specific—the tarantula—or, to the medium in which the dose is given, that is, the alcohol or ether. Everyone who has swallowed a bowl of punch, or a tumbler of toddy, knows that one of its properties is to induce perspiration, and all medical men at least know that ether has a like effect. We have, however, no reason to suppose that the constituent particles of a spider's body have any such effect. It is too obvious to have induced anyone to prove it, that, except the poison gland and its contents, there is no essential difference in composition between a spider and any other insect. The poison is no doubt an active principle, but it is infinitesimally minute in quantity, and if it bears any analogy to

CASE IV. the poison of other venomous animals, it is inert and innocuous, unless introduced into the circulation by a wound. The credit, therefore, of the tincture of tarantula as a sudorific appears to be due to the alcohol or ether, in which the inactive constituents of the spiders are administered. Their real medical value is now, at least in European practice, restricted, if it even remains to that extent, to that of a styptic for stopping the bleeding of slight cuts by external application.

Indirect advantage has been taken of the habits of spiders to supply the place of a barometer. There is a story of this having been done during the War in Holland, after the great French Revolution. Some years previously, when the Stadtholder had been re-instated in his dominions by the Prussian arms, a M. Quatremere d'Isjonval, a Frenchman (during the commotions which then occurred) was arrested and imprisoned at Utrecht, where he passed several years in captivity. To amuse the tedium of confinement he was wont to watch some spiders that happened to make their abode near him, and to cultivate their acquaintance. Whether he succeeded in taming them may be doubted, but he, at all events, satisfied himself that like many of the lower animals they were very sensitive to meteorological changes, and he got to know what changes their different behaviours portended. The information so obtained came to be useful by and by. In January 1795 he was released by the advance of the French. An intense frost had enabled them to pass the watery defences of the place. They had, however, scarcely taken possession when a rapid thaw commenced, and the French Commanders found their communications about to be compromised by the melting of the ice on the various streams across which it had allowed them to advance. In much anxiety they were about to retreat, when M. d'Isjonval, who had noticed the behaviour of his spider friends, communicated to the officers his confident assurance that the frost was about to set in again with greater intensity than ever. Whether relying on his assurance, or on other grounds, they suspended

CASE IV. their movement, and the very next day the frost recommenced with great severity, and continued long enough to allow the Republican troops to overrun the whole of the then undefended country. Perhaps the consolation spiders have afforded to poor prisoners like M. d'Isjonval by giving them some object of interest to occupy their minds, or the support to their courage which they have supplied to men in difficulties—such as Bruce's watching the seven times repeated efforts of his spider to attain its object —is even more deserving of commemoration; and although doubtless it is only the very few who have had patience and ability to get the spiders to recognise them or to establish friendly relations with them, some men would appear to have actually succeeded in doing so, or at least to have thought so, which was perhaps, just as good. Not all, however; M. Alphonse Karr, in his "Guèpes," tells that when he was consigned to prison for a few days for some infringement of the laws of the press in the reign of Louis Philippe, he tried the experiment without his usual success. "In imitation of divers celebrated prisoners," says he, "I searched for a spider in order to instruct it—I found a little black one, but it shows little capacity."

Spiders may be very naturally divided into two sections—the large, mostly tropical species, which have four breathing sacs and four spinnerets, and the ordinary spiders, with which we are familiar, that have only two breathing sacs (where there are apparently four, two of them are not sacs but tracheæ) and six spinnerets. The first constitute the family of

MYGALIDÆ or Crab-Spiders.

As already said all spiders have a large claw or poison fang hinged on to the front of their mandibles, but this family is distinguished by this claw being very large, hard, and polished—so much so that in Brazil it is sometimes set in gold and used as a toothpick, and it is thought to have some specific value in keeping away toothache. In the other section the fang moves

CASE IV. laterally. In the Mygalidæ it moves vertically as if it were pinning the creature it seizes to its own breast or like the claws of a lion closing on its prey. Species of these gigantic spiders are found in the Tropics all round the world.

Nos. 1 2. MYGALE AVICULARIA (*Walck*).—**1.** Specimen (o) ; **2.** Sketch, natural size.

Mygale avicularia (natural size).

This spider inhabits tropical South America. It is the species which has sometimes been called the bird-catching spider, (whence the name avicularia, which originated with Mme. Merian) from the idea that it occasionally caught or entrapped in its nest small birds, such as humming birds. The tale has never received actual confirmation, indeed it has been wholly denied. Langsdorf insists that it only eats insects, and Kirby and Spence give Mr. W. S. MacLeay's authority to the same effect from his own observations on Mygale avicularia, which was very common in his garden in Cuba. It did him great service by devouring the mite, achetæ, cockroaches, &c., which are so injurious there to cultivated vegetables. It issues from its hole in the night only

CASE IV. (never in the daytime) to attack these insects; and so far from its having any bird-catching propensities, Mr. MacLeay having placed a living humming bird in the tube of a Mygale, it deserted it, leaving the bird untouched. Still, the size of the spider is sufficiently great to render it not impossible, and the deleterious effects of its venom have been sufficiently proved to render it likely that if employed on small birds it might kill them. And if we cannot cite direct proof that its prey is often small vertebrate animals, we can at least give some indirect circumstantial evidence to that effect. As we write we have received an *envoi* and a communication from our friend the Rev. Dr. R. H. Nassau, one of the American missionaries on the coast of Gaboon. He sends an enormous Mygale, of which he says, "It was caught here" (Akele country, 200 miles up the river Ogove, and 150 miles from the sea) "last June. One of the boys in pursuing it struck it and smashed its body. I was exceedingly disappointed at its mutilation, but the head is complete. *I was amazed at the amount of blood that flowed from it.*" It is plain that Dr. Nassau here uses blood in its ordinary sense, viz., red blood; and if so, then it is equally clear that the blood could not be the spider's blood, which is colourless. It was obviously blood freshly sucked from some small vertebrate animal, such as a mouse or a bird. It is not uncommonly supposed that the way in which the spider obtains the humming-birds is by catching them in its web, which was imagined to be of proportionate strength and size to its own dimensions as compared with those of other spiders. This at least is a mistake. It spins no such web. It does indeed spin a cocoon of white silk to contain its eggs, but not a web. It is a hunting spider, and lies in ambush in its nest or in crevices or burrows, which it makes for the purpose, and catches its prey by rushing out upon it or hunting it.

Nos. 3, 4. MYGALE CALIFORNICA.—3. Sketch, natural size. From California. 4. Specimens of do.

The genus extends from Tropical America northwards on the

CASE IV. west coast of America to California, in the south of which the present species occurs. It is of a pale colour, between fawn and madder, and is comparatively small. It is usually found under stones.

Nos. 5, 6. MYGALE FASCIATA (*Koch*).—**5.** Sketch, natural size; **6.** Specimen (o).

This is a very remarkable looking spider on account of the contrast between the white bands which cross the legs and the rest of the colour of the insect. The colour is produced by a thick felt of white hairs.

Nos. 7, 8. MYGALE KLUGII (*Koch*).—**7.** Specimen from the Eastern Andes; **8.** Sketch of do.

This specimen was taken in the dry country of the Eastern Andes, lying on the western side of the Pampas between Mendoza and San Juan, where it is dreaded as extremely venomous.

Nos. 9, 10. MYGALE VERSICOLOR (*Koch*).—**9.** Specimen from Brazil; **10.** Sketch of ditto, natural size.

The name versicolor is not well chosen, for there is no great variation in the colour, it only being black with tawny hairs. In addition to its biting powers, its hairs, which readily come off and adhere to the skin, may give annoyance.

Nos. 11, 12. MYGALE ERICHSONI (*Koch*).—**11.** Specimen from Java; **12.** Sketch of do.

This has considerable resemblance to the Mygale fasciata, No. 5, and is also from Java.

No. 13. MYGALE CONVEXA (*Koch*) —**13.** Specimen from Old Calabar.

This species is from Old Calabar on the west coast of Africa, is smoother, more convex, and clothed with shorter and finer hair than most others.

CASE IV. MYGALE DETRITA (*Koch*).

Mygale detrita is a Brazilian species, but in a subsequent case (VI.) a specimen will be found from London docks. There is, however, nothing surprising in any species from any quarter of the world being found under favourable circumstances in London docks.

No. 14. ATYPUS SULZERI. (*Latr.*)—14. Sketch, natural size.

Atypus sulzeri (magnified twice).

Although none of the genus Mygale are found far beyond the limits of the Tropics, one or two allied forms occur in the temperate regions, and among them is the present species, which is found in Britain. It is one of our larger spiders, but is by no means common. It excavates, in humid situations, a subterranean gallery, which is at first horizontal, but inclines downwards towards its termination. In this gallery it spins a tube of white silk, of a compact texture, about half an inch in diameter, and the female deposits between thirty and forty eggs in a cocoon of white silk attached to its extremity.

Nest of Atypus sulzeri.

CASE IV. Part of the tube hangs at the outside of the aperture to protect the entrance, as shown in the wood-cut.

TRAP-DOOR SPIDERS.

Some of the spiders belonging to the family Mygalidæ, form subterranean burrows like the last species, which they line with a thick silken web, and, in addition, provide them with a door which opens on a hinge and fits closely. These trap-door burrows were first described as observed in Jamaica by Mr. Patrick Brown in 1756, and afterwards in the south of Europe by the Abbé Sauvages in 1763, and an account of them with figures was given by Mr. Saunders in "The Transactions of the Entomological Society of London," vol. 3, 1839.

There is a difference in the character of the door of these spiders; some have it falling loosely like a flap, others fitting into the tube like a cork or stopper.

Nos. 15, 16. CTENIZA IONICA (*Saunders*).—**15.** Nest of do., from South Europe; **16.** Sketch of spider of natural size.

Trap-door of Cteniza ionica.

This belongs to the section with cork-fitting trap-door, and was given to us as coming from the Ionian Islands.

Nos. 17, 18, 19. ACTINOPUS NIDULANS (*Brown*).—**17.** Nest of ditto, with specimens in the nest; **18.** Sketch of insect enlarged; **19.** Specimens of ditto, male and female.

The door of the nest of this species is an example of the kind

CASE IV. that falls like a flap. It is now placed in the genus Actinopus, but is better known by the old name Cteniza nidulans, and comes from Jamaica.

CTENIZA FODIENS (*Cambr.*).

This is a round-bodied blueish spider, from the south of France, which, as already said, makes nests with cork doors.

Cteniza fodiens (slightly magnified).

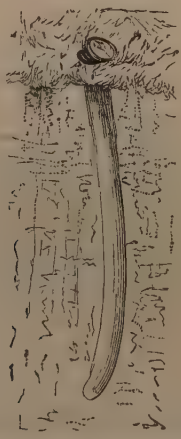
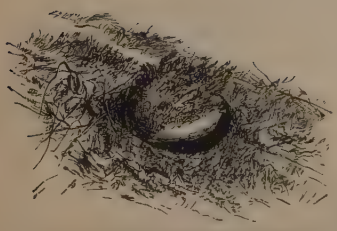


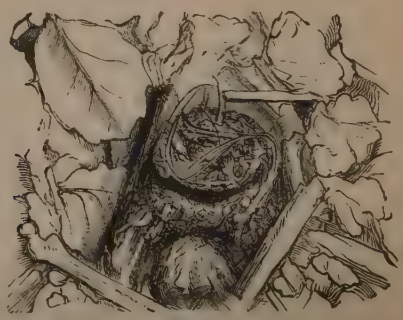
Diagram of tube of Cteniza fodiens, or of an allied species.

More recent observations have shown that there are several species of different genera that make these remarkable structures, an interesting account of which will be found in Mr. Moggridge's recent work on "Harvesting Ants and Trap-door Spiders." From this work it appears that the contrivances of these creatures are more complex than was formerly supposed. The first known piece of ingenuity was that the insect stoppered the hole into its burrow by a trap-door fitting like a cork, which was loaded with earth on the outside, sufficiently heavy to make it shut of its own weight, a contrivance which facilitates its concealment when mosses, etc., grew on the earth so placed. One of these is here

CASE IV. represented. This kind is very often overgrown by mosses. The flap, or wafer-door kind made by Nemesia eleanora, is much slighter, and the door not usually loaded with earth, nor has it anything growing on it. There was at one time a doubt whether the insect did not hold down the door with its claws, and some have thought that they observed foot-holds on the door for this purpose. It certainly, when it is near the door, and the door is then attempted to be



Trap-door of Nemesia cementaria, overgrown by moss.



Trap-door of Nemesia eleanora, on the bare ground.

opened, does hold it back to the best of its ability, but there does not seem to be any mechanical or structural preparation for such a contingency. Then it was ascertained that in Jamaica, at least, the nest had sometimes two doors, a front and a back door, as it were, that is, the nest was made in a raised bank which it entered at one side and came out at the other. This was supposed to indicate a deliberate selection of such a site, on the calculation that, whichever door was forced, it could then escape out at the other; but this implies a greater stretch of foresight than the circumstances warrant. It seems more likely that the spider commenced its burrow in ignorance, that it would break out on the other side of the bank, and that when it found it had done so, its trap-door-forming instinct came into operation, and led it to build a door at that opening as it had done at

CASE IV. the other. Mr. Moggridge has since shown that some of the species in the south of Europe, near Mentone, carry their ingenuity much further. One species there named, Nemesia

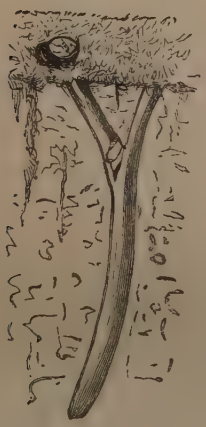


Diagram of tube of Nemesia eleanora.

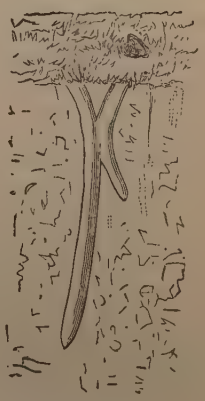


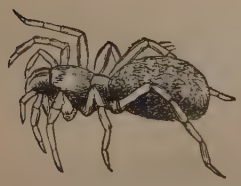
Diagram of tube of Nemesia meridionalis.

meridionalis, makes a tube into the ground like the others, and with the usual trap-door, but a short way down it makes another shorter tube sloping obliquely for a short distance upwards and downwards and at the junction of this it places another trap-door, only in this instance less solid and more flexible, and like a hanging curtain. It is, moreover, so constructed as to suit the convexity of the tube in which it lies, so that, when in its natural position, shutting the entrance of the second tube there is no appearance of the door at all. The eye on looking in penetrates to the bottom, and sees apparently nothing but an empty tube, whilst all the time the spider may be reposing securely in the second tube protected from view by the concave door. But that is not all; the spider can, if it chooses, push this inner door to, so as to close the main

CASE IV. passage, the effect of which is, that on looking in at the upper door one only sees a short tube with nothing in it, while the spider is behind the termination, ready to fly up the oblique tube if the door at the bottom should be forced, which would necessarily fall back and conceal from view the entrance to the upper tube, leaving to all appearance nothing but a silk-lined tube uniform throughout.

NEMESIA CÆMENTARIA (*Latr.*).

This is a rather large yellowish fawn-coloured spider, of which specimens are put in the next case.



Nemesia cæmentaria (scarcely magnified).

Nemesia eleanora (slightly magnified).

No. 20. NEMESIA ELEANORA (*Camb.*).—**20.** Diagram of the double-branched nest of, with an outer and inner trap-door, from Mentone, as above described.

This is a yellowish spider, very similar to Nemesia cæmentaria. Mr. Moggridge describes and figures various kinds of trap-door nests that he observed near Mentone, and no doubt if the rest of the shores of the Mediterranean were equally well searched, a greater number of species would be found.

During the last year two or three specimens of a trap-door spider's nest, constructed on another fashion in a peculiar locality, viz. in the bark of a tree, have been received in England from South Africa. The nest and lid are as nearly like the bark itself, as those from the ground are like the soil where they are made. It would appear from more than one of the same kind

CASE IV. having been found, that it was not accidental choice of situation, but that it is the regular manner of life of the inhabitant, to make a hole in the bark, and to close it with a door like the bark. But the spider's feelers are not adapted for digging a hole in so hard a material as bark or wood, and from the appearance of the place itself, where the nest that we have seen was made, it seems more probable that the spider had taken possession of the empty cocoon of some moth that, as many do, makes its cocoon in the bark of trees, and had woven a lid to it with silk and fragments of bark; it may be a habit of this particular trap-door spider to select such situations.

Since the preceding case was prepared, and the above remarks written, the museum has received from Lady Jardine, relict of the late Sir William Jardine, the celebrated naturalist, the donation of a number of trap-door spiders and their nests, of the kinds found and described by the late Mr. Moggridge, in the neighbourhood of Mentone, Cannes, and other points on the French or Italian littoral of the Mediterranean. As Mr. Moggridge's work has excited a good deal of interest in these creatures, an additional case has been added for their reception. Before describing them, however, it may be desirable to satisfy the reader's curiosity on two points on which it is likely to arise. If he looks at the specimens in this case, he will acknowledge that without the key, which we have added to each, to indicate the position of the trap-door, he would have great difficulty in finding it for himself, even when his field of search is reduced to a couple of inches, and he will naturally ask how in an open country any one could ever detect them; and his surprise will not be diminished when he is disabused of an erroneous impression, very likely to be created by the specimens of larger exotic trap-doors exhibited in last case. These would lead to the impression that their nests are much larger, and consequently more conspicuous than they actually are in the south of France, and its neighbourhood. The fact is that there, they are often very small, for both young and old spiders

CASE IV. make these nests, and the young ones, which are the most numerous, seldom go deeper than a couple of inches below the surface, and thus although the mechanism and structure of the nest is not far to seek when the entrance is once found, the dimensions are so small as greatly to increase the difficulty of finding them out. We have had the advantage of an explanation of the mode of procedure adopted by the late Mr. Moggridge from his father, now in England, himself an adept not less skilled in observing them than his talented and lamented son; and we do not think that we can better illustrate it, than by repeating a little anecdote told us by that gentleman.—It appears that not long since, Mr. Moggridge and one of his sons had occasion to visit Marseilles. Familiar as they were with the appearance of ground that was likely to be inhabited by trap-door spiders, it appeared to them that the neighbourhood of Marseilles looked a likely place in which to find them. Consequently, one of their first enquiries of the Entomological Curator of the museum there, to which they naturally paid an early visit, was whether trap-door spiders were found in the neighbourhood. The Curator replied that he thought he might confidently answer that they were not, for he had taken much interest in them, and had devoted a great deal of time to seeking for them without success. Mr. Moggridge said nothing in reply, but when they left the museum he said to his son, "Now let us go and try what we can do." They agreed to take different routes, so as to go over most ground, and separated on their search. Now it is plain that if these nests were scattered indifferently over the ground, a search for them would be a very haphazard affair, but there happen to be two circumstances which do not leave the searcher absolutely without a guide. In the first place they do not make their nests on the level ground, or if they do, the difficulty of finding them there has not hitherto been overcome; but on the sides of earthen banks, like the banks on each side of a deep worn road or lane, which constant use has

CASE IV.

cut deep beneath the level of the surrounding country, or in roads margined on each side by turf walls or embankments. And the level they affect in such banks is from two to four feet high, or a little below the line of vision of an average sized man. And in the next place it turns out that the hinges of doors are very slightly made (in London we should say that the work had been scamped), that they very soon wear through and give way, and the doors then drop off and roll down the bank. It is probable that a strong and lasting hinge would not be sufficiently flexible. But the frequent loss of the doors is made up for by the ease with which they are renewed. If we remove a door to-day, a new door, hinge and all, will be hung by to-morrow at the same hour; it may not be quite perfect, and may take another day or so to complete it to the spider's mind; but the door is on. The result of this insufficiency of hinges, is that doors that have dropped off and rolled down the bank, remain as tell-tale witnesses, to indicate that there is a nest in the bank a foot or two above, which only requires a careful search to be found. Sometimes they are so ingeniously like the surrounding earth, that they defy detection, but generally speaking, they can be found, at all events by an educated eye. Acting on this plan, Mr. Moggridge and his son spent the morning in reconnoitring the lanes in the vicinity of Marseilles, and next day were each able to surprise the Curator with a donation of several specimens that had rewarded their search.

When found, the next difficulty is to get them out entire, and for the purposes of such a museum as this, to bring them to England without crumbling to pieces. Here again care in cutting out, putting aside, and packing, and then, after filling the tubes with cotton, paying the earth around them again and again, with a weak solution of gum arabic, overcomes the difficulty. The nest can even be dissected out, so as to show the double tubes and chamber door, &c., if sufficient skill and neat-handedness be brought to bear upon it. We tried, but it would appear that we

CASE V. have not got these qualities in the requisite degree. We did not succeed to our satisfaction.

Section I.—Nests with Cork Doors.

Nos. 1, 2, Nest preserved in the ground, with relative key to show where the door is. From St. Cassien, Cannes, collected April, 1875.

3, Specimens of its maker, Nemesia cæmentaria, male.

4, 5, Another nest of ditto, and key.

6, 7, Ditto Ditto.

8, Specimens of Nemesia cæmentaria, female.

9, 10, Another nest of ditto, and key.

Section II.—Nests with Wafer Doors.

11, 12, Nest with two doors and key. A portion of an old nest or door lies in the right hand corner.

13, Diagram of double-doored nest, made by Nemesia eleanora.

14, 15, Another nest, with two doors, old inner door lying in the lower left-hand corner.

16, 17, Ditto Ditto.*

18, Specimens of the maker, Nemesia eleanora, male.

19, 20, Another nest, with two doors close together, and key. A portion of inner door or tube lies in upper left-hand corner.

21, 22, Another two-doored nest, and key.

23, Specimens of Nemesia eleanora, female.

24, 25, Single door, removed from No. 17.

26, Magnified sketch of Cteniza fodiens, a cork-nest spider.

---

* The specimen No. 17 was the one that we attempted to dissect, but, not succeeding, we were glad to restore it to the best of our ability. There was a third door close beside the other two, which we have put as a separate specimen in No. 24. Nos. 17 and 24 are the only two where the ground has been meddled with, further than gumming together.

CASE V. Magnified sketch of door made by ditto.

Nos. 27, 28, 29. Magnified figure of Nemesia eleanora, a wafer-nest spider. Magnified sketch of door made by ditto.

CASE VI. Nos. 1, 2. MYGALE DETRITA (*Koch*).—**1.** Sketch of insect ; **2.** Specimen of ditto, taken in London Docks. See above (p. 55).

THERIDIIDÆ.

THE characters of this and the next group (Lycosidæ), will be noticed when we come to speak of them as British spiders. At present we take in separately here one or two of them that are not British, but have acquired an ill reputation as being dangerous and venomous. They are the following, viz. :—

No. 3. LATRODECTUS MALMIGNATUS (*Walck*).—**3.** Enlarged figure of do.

This spider is black, with ten blood-red spots, which are more or less semilunar. It is common in some parts of the south of Europe, more particularly in Catalonia, and it possesses the dangerous power of inflicting a poisonous wound that kills small insects instantaneously, and affects the larger animals seriously—man himself having sometimes succumbed to the stroke.

Latrodectes malmignatus (slightly magnified).

Previous to 1830 its venomous properties appear never to have been noticed or heard of by any of the old inhabitants, but in 1830, 1833, and 1841 many dangerous accidents from its bite occurred, which directed attention to it. The enquiries consequently made established beyond doubt its venomous properties. The spider was

CASE VI. seen to despatch any insects detained in its toils, though as large as a locust or a cicada, by a bite, which was usually inflicted in the joints between the armour of the head and neck. The insect, if small, died instantaneously; if larger, it appeared at first to undergo something like a convulsion, which presently gave way to a state of total prostration, rapidly terminating in death.

It may be the same species, or at any rate an allied one, that is referred to by Kirby and Spence in their "Introduction to Entomology," of which they say: According to Mr. Jackson, a spider called there the *Tendaraman* is found in Morocco, which has formidable but no doubt much exaggerated venomous powers. It is about the size and colour of a hornet, and spins a web so fine as to be almost invisible. Its bite is said to be so poisonous that the person bitten survives but a few hours. In the cork forests the sportsman, eager in his pursuit of game, is said frequently to carry away on his garments this fatal insect.

The insect is black, with ten blood-red mostly crescent-shaped marks on the abdomen.

There is an allied species found in Corsica, where it also is known by the same name, or at least a provincial modification of it, viz., Marmignatto or Marmagnatto (Theridion tredecim-guttatum). Although it does not there seem to be so formidable as in Catalonia, its bite is said to cause much pain, even to man, and, according to Rossi, induces serious symptoms, which require sharp treatment, copious perspiration being one of the best cures. Grasshoppers and locusts seem to be its favourite food, and it is said to stretch long threads across the furrows in the fields to entangle the feet of its more active prey. When it catches a locust it, like other spiders, secures the insect by spinning threads round its limbs, when it inflicts a fatal wound at the junction of the head with the neck. As soon as the locust has received the bite, it is attacked with a violent convulsion, and dies almost instantaneously.

This species is black, with thirteen round blood-red spots on the abdomen.

CASE VI. Another species of Latrodectes, from the south of Russia, having similar properties, has been described by Motschulsky, and he has given it the name of Latrodectes lugubris. The same noxious properties are found in a species of the same genus, called the Kalipo, that inhabits New Zealand. An account of the effects of its bite, and of the remedies used against it, will be found in the Transactions of the New Zealand Institute, 1869.

THERIDION BENIGNUM (*Walck.*).

Another species of Theridion (called benignum from its being so unusually benignant in disposition that husband and wife are actually able to live together without eating each other up) is interesting to man from an economic point of view. In the south of Europe it is common in gardens, especially in autumn. Where the grape vine is cultivated its webs are thought to be useful in preserving the clusters of grapes from the attacks of other insects. Its webs, though of slender texture, are very plentiful in some places, so much so that almost every bunch of grapes has its protecting network of web thrown over it.

LYCOSIDÆ (Wolf Spiders).

The wolf spiders are a family of rather large spiders that take their prey not by lying in ambush but by regular chase. The most celebrated of them is the Lycosa Tarantula, which was supposed to give rise to the disease Tarantismus or Tarantula dance. It was named after the town of Tarentum in Italy, where it is common, and where no doubt it occasionally bites people. So far as actual scientific observation has gone, the result of the bite appears either to be nothing at all, or to be limited to some uneasiness or swelling. Kirby and Spence mention that Dr. Cavitro submitted to be bitten by this animal, and no bad effects ensued, and that the Count Deborch, a Polish nobleman, bribed a man to undergo the same experiment, in whom the only result was a swelling of the hand, attended by intolerable itching. The

CASE VI.

fellow's sole remedy was a bottle of wine, which charmed away his pain without the aid of pipe or tabor. That it does this extent of injury is probably the true version of the tale, because Count Motschulsky describes another species, from the south of Russia, to which similar offensive properties are ascribed. But such moderate annoyance is by no means the effect which in the last century was popularly supposed to be produced by the bite of this spider. The Tarantismus either affected anyone bitten by throwing him into a profound and moody melancholy similar to what is often to be seen in our lunatic asylums under the name religious depression, or in frantic dancing and gesticulation, which often terminated in convulsions. The remedy was music, which timed the dancing, and the curious thing was that it did not seem necessary that each patient should be bitten by the Tarantula—a Tarantula patient infected all that came near him. The consequence was that the disease ran through whole districts and villages like an epidemic. There is no reason to dispute that it did so, and that hundreds were affected at the same time by this dancing disease, but the Tarantula had nothing to do with it. It was one of those examples of the results of unnatural excitement which in all countries, and especially under the influence of religious impressions, has produced similar consequences. The dancing dervishes of India, the shakers of America, and individual examples at religious revivals in our own country, probably all suffer more or less from something allied to the Tarantula of Italy.

Lycosa tarantula (slightly magnified).

No. 4. LYCOSA TARANTULA (*Linn.*)—4. Sketch of ditto, slightly magnified.

CASE VI.

BRITISH SPIDERS.

In order to give some general idea of the different kinds of spiders that inhabit Britain, we have next displayed a series of examples and illustrations of the different families and most of the genera of British spiders. The arrangement is that of the Rev. O. P. Cambridge, published in the Linnean Society's Transactions 1874, which seems in some respects an improvement upon that adopted by Mr. Blackwall, our great British arachnologist, in his important work, "The Spiders of Great Britain and Ireland," published by the Ray Society.

Family MYGALIDÆ.

Sub-Family THERAPHOSIDÆ.

ATYPUS SULZERI (*Latr.*).—See Case IV., No. 14.

Family DYSDERIDÆ.

The Dysderidæ, along with the genus Scytodes, which will be found further on, are the only British spiders that have six eyes, the rest all having eight, and they have consequently been placed in a separate division by themselves, but they are clearly nearly united to the genus Atypus, on the one hand, and the Drassidæ on the other, which shows that too much value must not be placed upon the number of eyes as a character of natural affinity. The Dysderidæ live in holes in the ground and crevices in rocks and walls or in cells and tubes of silk constructed under stones and take their prey by hunting.

No. 5. OONOPS PULCHER (*Templ.*).—5. Sketch of ditto, enlarged.

This is a minute fawn-coloured spider.

CASE VI. Nos. 6, 7. DYSDERA CROCATA (*Koch*), D. rubicunda, *Bl.*—**6.** Specimen from near London; **7.** Sketch of ditto, enlarged.

Dysdera crocata (slightly magnified).

Rather a large reddish spider, about half an inch in length, with a whitish abdomen.

No. 8. HARPACTES HOMBERGI (*Scop.*), Dysdera Hombergi, *Bl.*—**8.** Sketch enlarged.

A smaller species with black thorax, fawn-coloured abdomen, banded legs, black and pale, plentiful.

Found in the wooded districts of Denbighshire, Carnarvonshire, Lancashire and Yorkshire, living in crevices in rocks and walls, and under lichens growing on trees.

No. 9. SEGESTRIA SENOCULATA (*Linn.*).—**9.** Sketch of, natural size.

About the same size as Dysdera crocata, with a rich brown thorax, and fawn-coloured legs and abdomen.

Family DRASSIDÆ.

The Drassidæ are rather narrow spiders of moderate size, which obtain their prey by hunting. They conceal themselves in silken cells, often open at each end, which they construct under or among the leaves of plants, in the crevices of rocks and walls, and under stones and decaying or exfoliating bark.

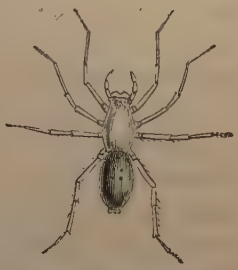
No. 10. MICARIA PULICARIA (*Sund.*), Drassus micans, *Bl.*—**10.** Sketch, enlarged.

Some few spiders, more especially from tropical countries, are as brightly polished and burnished with metallic colours as beetles often are. This one has a moderate share of such brilliancy on the abdomen.

CASE VI. No. 11. DRASSUS BLACKWALLII (*Thor.*), D. sericeus, *Bl.*—**11.** Sketch, enlarged. Brown thorax and legs; black abdomen.

No. 12. CLUBIONA PALLIDULA (*Clerck.*), C. epimelus, *Bl.*—**12.** Enlarged sketch.

A rather large brown species with a dark abdomen.



Drassus sericeus (very slightly magnified).

No. 13. CHIRACANTHUM NUTRIX (*Westr.* non *Bl.*). —**13.** Enlarged sketch.

Pale species, with a darker abdomen bearing a high longitudinal marking.

No. 14. HECAERGE MACULATA (*Bl.*).—**14.** Enlarged sketch.

Pale fawn-coloured; thorax longitudinally striped, and abdomen spotted with black.

Family DICTYNIDÆ.

This family is a new one, proposed by Mr. Cambridge, composed of the genera Eresus and Ergatis of Blackwall (Dictyna of Sundeval). These genera do not in all respects combine well together. Eresus is a hunting spider; Ergatis a kind that spins a web. There are also material differences in the structure, and the family may probably not stand. Blackwall places Eresus among the Salticidæ and Ergatis among the Ciniflonidæ, a family that Mr. Cambridge suppresses, and distributes its members in other families.

Eresus cinnabarinus (slightly magnified).

No. 15. ERESUS CINNABARINUS (*Oliv.*).—**15.** Enlarged sketch.

Above black, with a scarlet patch at the base of each side of

CASE VI. the thorax; abdomen, bright scarlet above, with six black spots on the scarlet abdomen, each of which is surrounded by a ring of white hairs: below, all black except a white patch near the posterior extremity.

Nos. 16, 17. DICTYNA ARUNDINACEA (Ergatis benigna, *Bl.*).—16. Enlarged sketch; 17. Do., sketch of cocoons of do.

This is a dark-coloured spider, with a sort of herring-bone pattern on the back of the abdomen. It spins an irregular web at the ends of the twigs of heath and gorse, and the female constructs two or three lenticular white cocoons of a compact texture, which she attaches to the stems surrounded by her web, enveloping them with the refuse of her prey.

Family AGELENIDÆ.

Mr. Cambridge proposes some alterations on this family. He removes the water-spider (Argyroneta aquatica) from the Drassidæ and places it here. Its aquatic habits had already suggested to other authors to place it by itself—but there are species in other families which take to the water in the same way as it does. He includes with it the most of the Ciniflonidæ of Blackwall and his Agelenidæ or house spiders (Tegenaria). They all spin webs, and lie in ambush for their prey; but the fabric of the web is not the same in all. In the Ciniflonidæ it is peculiar, and they have a special apparatus on the hind leg called a calamistrum, which is used in the manufacture. On that account we hesitate as to the propriety of absorbing the Ciniflonidæ; but on the other hand it is to be acknowledged that the whole of the spiders composing the group as adjusted by Mr. Cambridge have all the same general type and facies.

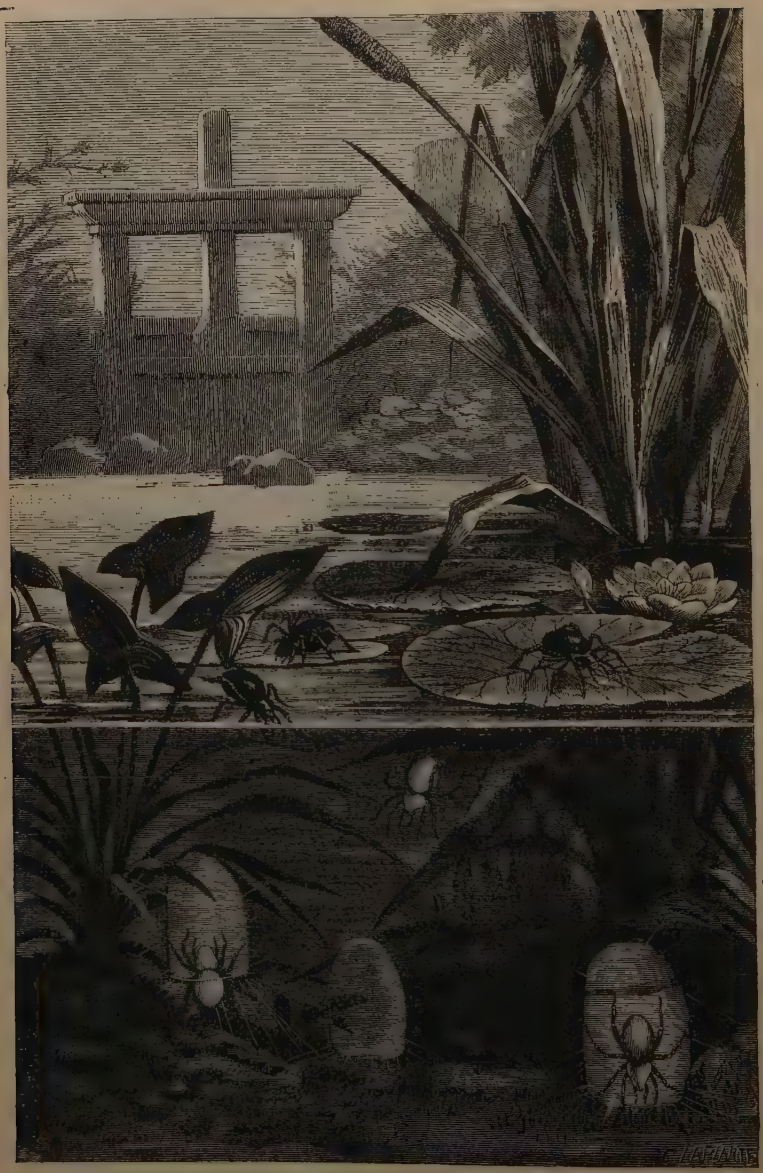
No 18. ARGYRONETA AQUATICA (*Linn.*).—18. Enlarged sketch.

About half an inch in length; thorax, dark reddish brown; abdomen, olive brown.

CASE VI. The interesting habits of this species are well known, and have led to their being often kept as pets. Indeed a few years ago it became so much a fashion that, like sea anemones during the rage for aquaria, they have become scarce, even in localities such as the ditches about Oxford or Cambridge, which are most adapted for them, and where they were formerly plentiful, they having been caught and sent up to London in quantities for sale by dealers in objects of Natural History.

They can live indifferently either on dry land or under water, but practically they spend the greater portion of their time in the latter. Their eggs are moored in silken cocoons to the stems of aquatic plants, under a dome-shaped cell, which is filled with air like a diving bell, by the spider carrying down successive globules of air between its legs, which it liberates under the dome until it is filled,—and the young are hatched there. The spider on its way through the water never gets wet. It is clothed with hair, which, combined with its respiratory organs, enable it to surround itself with a halo or enveloping bubble of air in which it moves about protected from wet and well supplied with air to breathe. It can be drowned for want of air, however, as well as any other animal. Mr. Blackwall mentions such a case. One of these creatures which had been got in the fens of Cambridgeshire was given to a friend. On being placed in a large goblet more than half filled with water, it speedily formed its dome-shaped cell beneath the surface, attaching it to the side of the glass by means of numerous silken lines, and being well supplied with insects, it lived in this state of

Argyroneta aquatica, water spider, female (slightly magnified).



Water spiders under the water. From Messrs. Blackie and Son's work "The Universe."

CASE VI. captivity till the commencement of winter, when, on the temperature of the room in which it was kept becoming much reduced, it entered the cell and remained there in a state of torpidity with its head downwards. A gentleman on a visit at the house, whose curiosity to examine the spider minutely in its hibernaculum was greater than his prudence, inclined the glass so much that the air escaped from the cell, the water flowed in, and before information of the circumstance was given the dormant spider had perished. The spider feeds upon any insects it can catch, whether water or land species; and whether she gets them on shore or not she generally carries them into her cell to suck their juices there.

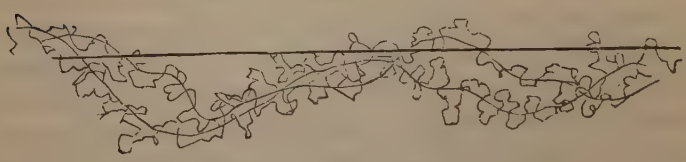
No. 19. AMAURORIUS FEROX (*Walck.*), Ciniflo ferox, *Bl.*—**19.** Enlarged sketch.

Pale brown; abdomen darker, with pale pattern on its back.

The web of this species, and of three or four others, considered by some a distinct family, under the name of Ciniflonidæ, is peculiar. It escaped notice for long, for it presents at first sight an irregular, ragged, and generally a dirty appearance, and might easily be passed by with little notice, as an old or deserted web. Mr. Blackwall pointed out, however, that even with the naked eye it can be seen to differ greatly from the webs of other spiders, which—whether as in the *Theridiidæ* they are a mass of clear distinct lines; or, as in the *Agelenidæ*, of a close even texture; or, as in the *Epeiridæ*, open nets, constructed on a regular plan—

Ciniflo ferox (twice magnified).

CASE VI. are all composed of simple threads; (more correctly, of threads composed of many strands, which become entirely united), whereas the web of the *Ciniflo* is a loose, irregular open net, formed of



Fabric of the web of the Cinifonidæ.

flocculous compound threads. These are very beautiful under the microscope. One straight line usually forms the foundation of the compound thread, and this is accompanied by several lines of extreme fineness, some of which are merely slack, while the rest are curled and twisted in every direction, by the operation of the spines forming the calamistrum. When newly spun, these threads have to the naked eye a bluish colour, but being very apt to entangle dust, the net is most frequently found in a foul and discoloured state. When handled, it clings to the fingers with remarkable tenacity. This is said to arise from the structure, rather than from any peculiar viscidity of the thread. The bluish colour of the web has been already noticed, and viewed in the microscope with the help of the parabolic condenser, the compound thread appears to be enveloped in something like a bluish cloud or vapour. Whatever this substance may be, (and it is so transparent as easily to escape observation under even the most

Calamistrum of Ciniflo (enlarged).

Part of ditto (more magnified).

CASE VI. favourable circumstances,) it is probably the cause of the colour of the web, and perhaps also of its clinging so closely to whatever it touches.

No. 20. AMAURORIUS MORDAX (Ciniflo mordax, *Bl.*).—**20.** Enlarged sketch.

Fawn-coloured; about half an inch in size.

No. 21. AGELENA LABYRINTHICA. (*Clerck.*)—**21.** Enlarged sketch.

Agelena labyrinthica, female (slightly magnified).

Brown, with a paler herring-bone pattern on the back of the abdomen.

The specific name of this species (labyrinthica) is probably derived from the form of its web or nest. In autumn we often see in hedges or heaths a rather considerable and thick mass of white strong compact spider's web, from part of which a sort of funnel or cylindrical tube runs downwards; the mouth opens wide and extends outwards usually for some distance as a simple single horizontal web, but gradually narrows at the inner end until it ends in a tube or tunnel large enough to admit one's finger. This tube frequently opens into one or more tubular

CASE VI. chambers. The walls also gradually get thicker until they look like a complicated mass of irregular web running in every direction. This is the nest or web of an Agelena.

No. 22. TEGENARIA GUYONII (*Guer.*), Tegenaria domestica, *Bl.*—**22.** Enlarged sketch.

Not unlike the preceding, but with larger legs.

Tegenaria guyonii (somewhat enlarged).

The Tegenariæ are the spiders that spin their webs in the angles of walls, in outhouses and neglected rooms, and come especially under the cognizance of the house-maid. From their position their web is usually a horizontal triangular sheet with a short little tube or nest at the inner angle. With occasional repairs it will last a considerable time.

Family SCYTODIDÆ.

The Scytodidæ prefer warm countries. They are of moderate size and have long legs, but are slow in their motions and feebly armed. One or two females have been taken in Britain, but as yet no males.

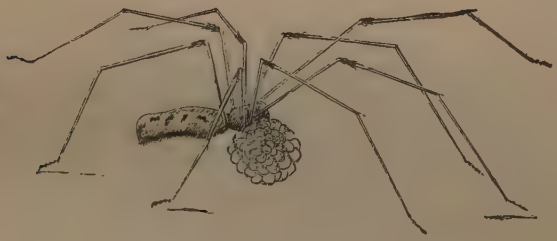
CASE VII. SCYTODES THORACICA (*Latr.*).—**23.** Enlarged sketch.

No. 23. Yellowish. The abdomen is spotted with black.

Family PHOLCIDÆ.

No. 1. PHOLCUS PHALANGIOIDES (*Walck.*).—**1.** Enlarged sketch.

Easily recognised by its long body and very long legs. It is of a pale colour, with irregular faint markings; the knee joints are thick and dark. It forms a loose hanging web in the corners



Pholcus phalangioides (slightly enlarged).

of rooms, &c. Like many other spiders, the female carries about with her the cocoon containing her eggs: it is of a slight texture, and the eggs and young when newly hatched may be seen through its walls.

Family THERIDIIDÆ.

The species of this genus are distinguished by the abdomen being large rounded or angular, and overhanging the thorax. They form snares composed of fine threads crossing each other in all directions, attached to the surrounding bushes or herbage, and the general character of the snare is constant throughout the family, however it may vary in individual species. Some of them also form curious delicate tents for the protection of their cocoons from the weather. To this family belongs the venomous species Latrodectes malmignatus, &c., already described.

CASE VII.

No. 2. THERIDION TEPIDARIORUM (*Koch*).—**2.** Enlarged sketch.

Theridion tepidariorum (magnified twice).

Dark brown, with a paler abdomen mottled with dark brown and black.

Not uncommon in conservatories in this country, but as it is confined to them there is little doubt that it is an exotic species which has been imported. The colour is brown and black, with a wavy marking. It makes one of the curious tents for its cocoons of which we have above spoken.

No. 3. THERIDION RIPARIUM (*Bl.*). — **3.** Sketch of nest.

Nest of Theridion tepidariorum. Copied from figure in Blackwall' "Spiders."

Reddish brown, with abdomen variegated with black and white.

This is another species which fabricates a curious tent, or nest, of which a figure is given. It is a slender conical tent of silk, something like a flat cap, measuring from one and a half to two and a half inches in length, and about half an inch in diameter at its lower extremity. It is

CASE VII.

closed above, open below, thickly covered externally with bits of indurated earth, small stones, and withered leaves and flowers, which are incorporated with it, and is suspended perpendicularly, by lines attached to its sides and apex, and is surrounded by its irregular snare. In the upper part of the tent the female spins several minute globular cocoons of yellowish-white silk, of a slight texture, containing each from twenty to sixty small spherical eggs, of a pale yellowish-white colour. The young remain with the mother for a long period after quitting the cocoons, and are provided by her with food, which consists chiefly of ants.

THERIDION LINEATUM (*Walck.*).

Usually pale greenish or yellowish white, tricked off with delicate black lines; but it is variable in colour, and in some individuals has a bright crimson oval or linear space on the abdomen. It provides for the safety of its cocoon (which is globular and formed of blueish white or greenish blue silk) by fastening it to the surface of a leaf and curling the edges of the leaf over it, as here shown.

Cocoon of Theridion lineatum. Copied from Mr. Blackwall's figure.

THERIDION PALLENS (*Bl.*).

A small pale-coloured species. The female has a brown irregular semilunar mark enclosing white on the back of the abdomen; the male has a dark stripe down the middle of the thorax, and a dark brown irregular mark on the abdomen.

We notice this species for the sake of its cocoon, which may often be seen on the under side of leaves of shrubs

Cocoon of Theridion pallens, on part of an oak leaf.

CASE VII. and trees. It is white, of a close fine texture like plaster of Paris, and is somewhat pear-shaped, with several little points projecting from its surface.

Family LINYPHIIDÆ.

This family is included by Mr. Cambridge among the Theridiidæ, but in this instance we prefer to follow Mr. Blackwall's arrangement. They are small insects, many of them black or brown and others grey, and often the abdomen is more or less barred with black. They frequent foliage or overhanging banks or other projections, and fabricate a fine horizontal sheet of web, supported by its margin and threads like guy-ropes stretching out in various directions, on the under side of which they take their stand in an inverted position.

No. 4 LINYPHIA MONTANA (*Walck.*)—**4.** Enlarged figure.

A very common species. It constructs, in hedges and rank herbage, a large horizontal web, which is connected with surrounding objects, especially above by numerous fine lines, that not only serve to support the web, but also to precipitate such insects as strike against them, on to the horizontal sheet, where they are quickly seized by the vigilant occupant.

Nos. 5, 6.

Walckenaëria pratensis, female (magnified).

WALCKENAËRIA PRATENSIS (*Bl.*).—**5.** Enlarged figure of male; **6.** Enlarged figure of female.

The genus Walckenaëria is composed, with very few exceptions, of minute dark brown or black glossy spiders, without any pattern or variation of colour on the body. They are the tiny creatures that everyone must remember to have come against in autumn, hanging by a thread from door lintels or branches, when they become entangled in our

CASE VII.

hair or garments, and are rather difficult to be brushed away from the adhesiveness of the thread by which they hang.

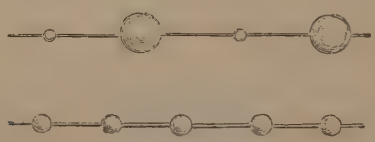
There is another genus named Neriene, that comes next to this, and is similar to it in appearance, and has similar habits—also one named Pachygnatha, which is of a brighter colour (reddish-fawn), and is distinguished by having very thick diverging mandibles.

Family EPEIRIDÆ.

Facsimile of web of Epeira diadematа.

The Epeiridæ are the hump-backed, globose looking spiders that are usually found in gardens, often watching in the centre of a radiating geometrical web placed vertically. Many of them are very beautifully marked on the back of the abdomen. Their web differs from that spun by any other spider. The thread consists of an elastic spiral line, thickly studded with minute globules of liquid gum, whose course is crossed by radii converging to a common centre, which is immediately surrounded by several

CASE VII. circumvolutions of a short spiral line devoid of viscid globules, forming a station from which the toils may be superintended by their owner without the inconvenience of being entangled in them. The spiral thread is also peculiar. It presents the appear-



Threads of web of Epeira.

ance of a string of glittering beads, sometimes uniform in size, and sometimes of different dimensions. These glittering beads are globules of gummy matter, which does not harden on exposure to the air, as that of which the other threads are composed does. The nets are renewed either wholly, or at least their concentric circles, every twenty-four hours, even when not apparently injured.

No. 7. EPEIRA QUADRATA (*Walck.*).—7. Enlarged figure of ditto.

This is a large and handsome species. The colour of the abdomen varies, in different individuals, from sage-green, through orange yellow, to dark brown with white marking. It is not uncommon in some of the uncultivated districts of England and Wales. It spins a yellow cocoon for its eggs, which looks very soft and flossy, from being formed by a succession of loops, exactly on the same principle as that adopted by ladies for making a similar texture in their silk or worsted work.

No. 8. EPEIRA ARBUSTORUM (*Koch*), Bicornis (*Walck.*), *Bl.*—8. Enlarged figure of ditto.

A rare species, remarkable by its having two humps on its back. The thorax and back of the abdomen is brown, the rest green.

CASE VII. No. 9. EPEIRA DIADEMATA (*Clerck*), Diadema, *Bl.*—**9.** Enlarged figure of ditto.

This is the species known as the "garden spider." In France it is the "Porte-croix" or "Croix de St. Denis."

It is common in our gardens in September. The cocoon is formed in October, and is about ⅔ in. in diameter, of a roundish shape and yellow colour, and contains a flattened mass of eggs. When the eggs are newly hatched, which takes place in spring, it is said that the following curious sight may be seen. The little spiders, almost as soon as they leave the egg, spin a small irregular mass of almost invisible lines, in the middle of which they cluster together, forming themselves into a little ball about the size of a cherry stone. This hangs apparently in mid-air, and if an observer, approaching it to discover its nature, touches some one of the slender lines by which it is suspended, or some twig near enough to communicate the motion to them, in an instant some six or eight hundred living atoms begin to disperse—the solid little ball seeming for a moment to be turning into smoke, so minute are the animals, so rapid their motions, and so invisible the means of their dispersion. After a few seconds, if the disturbance be not repeated, the little creatures begin to subside again into a cluster, but this is not at once restored to its former small size; and, indeed, it is easy to understand that upwards of six thousand legs, however small, must require some time in the packing, not to mention six or eight hundred pairs of poison fangs, which perhaps, even at this early age, may exact due observance on behalf of their respective owners.

Epeira diadematа (slightly magnified).

This spider has, like some others, a habit of quivering rapidly in its web. It has, also, a mode of disabling a victim, by twirling it, and at the same time winding threads around it, till it is entirely swathed in a strong silken covering. By this means large and strong insects are reduced to a meekness of demeanour which

CASE VII. enables their host to keep them alive in the web, and so secure himself a supply of fresh provision.

Family ULOBORIDÆ.

This section has been proposed by Mr. Cambridge for two genera, which it is difficult to arrange elsewhere, Uloborus (Veleda of Blackwall) and Hyptiotes.

No. 10. ULOBORUS WALCKENÆRIUS (*Latr.*), Veleda lineata, *Bl.*—**10.** Enlarged sketch of ditto.

A small fawn-coloured species marked with longitudinal lines on the abdomen. The length of the female is $\frac{1}{8}$ of an inch. It is very rare in England. It is said to form a web like the Epeiridæ.

Family THOMISIDÆ.

This is the most crab-like family of British spiders. Like many crabs, the body is short, broad, depressed, and angular, and their two anterior pairs of legs are long and powerful, while the two posterior pairs are generally small and feeble, and the whole are so constructed that the spider moves backwards, forwards, or sideways, with equal ease. They live by hunting, and some run with extraordinary celerity; others are more tardy, and lie in ambush in holes and crevices, to spring upon any prey that may come within their reach. They are generally pale with darker markings and waving black lines round the margin of the abdomen.

XYSTICUS CRISTATUS (*Clerck*).

Pale, with a dark stripe on each side of the thorax, and a zig-zag border on the abdomen.

This is a very common and variable species, found on the ground and in old pastures. One of its habits is that of rising in the air by the help of fine silken threads spun by it, and which, being carried upwards and onwards by currents in the air,

CASE VII. raise the spider, and enable it to float to considerable distances. These threads must not be confounded with gossamer, which is composed of numerous lines or webs, brought together by gentle currents of air, and adhering by the viscid properties of the web. There is nothing remarkable in this; but the circumstance that

Xysticus cristatus (twice magnified),

Xysticus audax (twice magnified).

excites our surprise is the vast quantity of gossamer that may be seen on a warm misty morning in autumn, covering every bush and tuft of grass for miles. It is only in autumn that it occurs, when the young broods of spiders are in full numbers, and it shows not only their great numbers but the rapidity of their manufacture. This, however, we already knew, for it is matter of common observation that a large web of the garden spider may be swept away and replaced in a few hours. In fact, there is not anything more industrious in the matter than in the *Great Eastern* ploughing its way through the ocean, and paying out a deep-sea cable as she goes. The whole industry of the spider consists in its walking from one point of attachment of the web to another, no doubt guiding the line with her claws as she goes, and of course to make a large geometrical web there must be a good deal of walking; but there is no industry in spinning the web. It is manufactured and payed out by nature as fast as it is wanted.

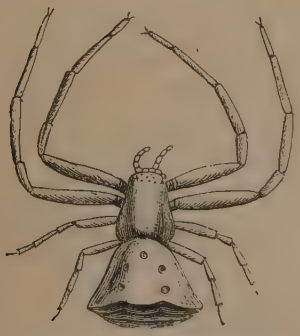
CASE VII. No. 11. Xysticus pini (*Hahn*), Thomisus audax, *Bl.*—**11.** Enlarged sketch of ditto.

Similar in appearance to the last.

No. 12. Thomisus onustus (*Walck.*), Th. abbreviatus, *Bl.*—**12.** Enlarged sketch of ditto.

A yellow species with the abdomen so much turned down as to appear abruptly truncate.

No. 13.



Thomisus abbreviatus (slightly magnified).

Diæa dorsata (*Fab.*), Thomisus floricolens, *Bl.*—**13.** Enlarged figure of ditto.

Found in chalk and limestone districts; the male and female differ much in appearance. The female has the cephalo-thorax and legs green, the abdomen yellowish, with a large brown mark on the back. The male is slenderer, has the cephalo-thorax red, and the abdomen yellowish, with oblique brownish bars. The legs are reddish and green.

No. 14. Philodromus margaritatus (*Clerck*), Ph. pallidus, *Bl.*—**14.** Enlarged figures.

Rather a large species (more than ¼ of an inch in length), pale greenish olive, barred a little with brown, and with pale brownish legs mottled with light brown.

Nos. 15, 16. Micrommata virescens (*Clerck*), Sparassus smaragdulus, *Bl.*—**15.** Enlarged figure of male. **16.** Ditto of female.

The female and young male of this spider are entirely green, but the full grown male has the abdomen with a broad yellow longitudinal stripe down the upper side, bordered by two bright red lines, and a bright red angular pointed one in the middle. Like its congeners, it is a hunting spider, and is very rapid in its

CASE VII. motions. The female makes a cell for her cocoon, which is green and large, but slight in texture, by rolling together two or three leaves, and tying them together by threads.

Family LYCOSIDÆ.

Some particulars regarding this family (the wolf spiders) have been already given in speaking of the Tarantula. There are twenty-seven species belonging to it known to inhabit Britain, some of which are similar in marking to the Tarantula, but none so large. They construct no snares, but lead a vagabond and hunter's life. The cocoon is peculiar, like two flat cups or saucers joined together, which give way at the suture, and allow of the escape of the young, which hang about the body of the mother for about a fortnight, being dependent on her for food until they are able to provide it for themselves. There are two broods in the course of the year.

No. 17. DOLOMEDES FIMBRIATUS (*Clerck*).—**17.** Enlarged figure.

This is a semi-aquatic spider, which has been called the raft

Dolomedes fimbriatus (slightly magnified).

spider from its habits. It is one of the largest British spiders, is of a brown colour, with a broad orange band encircling the upper

CASE VII.

surface of the thorax and abdomen. A double row of small white spots are ranged longitudinally on the back of the abdomen, and the legs are pale red. It is only to be found in fenny or marshy places, and its best known habitat is the fens of Cambridgeshire, where its remarkable habits have long been known, Mr. Wood, in his "Homes without Hands," gives the following: Not content with chasing insects on land, it follows them to the water, on the surface of which it runs freely. It needs, however, a resting place, and forms one by getting together a quantity of dry leaves and similar substances, which it gathers into a rough ball and fastens with a silken thread. On this ball the spider sits, and allows itself to be blown about the water by the wind. Apparently, it has no means of directing its course, but suffers its raft to traverse the surface as the wind or current may carry it.

There is no lack of prey, for aquatic insects are constantly coming up to breathe the air, and although they may only remain on the surface for a second or two, the spider can seize them before they gain the safe refuge of the deeper water. Then there are insects, such as the gnat, which attain their wings on the surface of the water, and can be taken by the spider before they have gained strength for flight. Also there are insects which habitually traverse the water in search of prey, and which are themselves seized by the more powerful and equally voracious. More than this, moths, flies, beetles, and other insects, are continually falling into the water, and these afford the easiest prey to the raft spider, who pounces upon them as they vainly struggle to regain the air, and then carries them back to its raft, there to devour them in peace. The spider does not merely sit upon the raft, and there capture any prey that may happen to come within reach, but when it sees an insect upon the surface, it leaves the raft, runs swiftly over the water, secures its prey, and brings it back to the raft. It can even descend below the surface of the water, and will often crawl several inches in depth. This feat it

ASE VII. does not perform by diving, as is the case with the water spider, but by means of the aquatic plants, down whose stems it crawls. Its capability of existing for some time beneath the surface of the water is often the means of saving its life; for, when it sees an enemy approaching, it quietly slips under the raft, and there lies in perfect security until the danger has passed away. There is living in the same localities a closely-allied species, the Pirate Spider (Lycosa piratica), which has similar habits, chasing its prey on the water, and descending as well below the surface. It does not, however, possess the habit of making a raft.

It carries its cocoon about with it, like other spiders.

o. 18. TROCHOSA CINEREA (*Fab.*), Lycosa allodroma, *Bl.*—**18.** Enlarged figure.

A rather large grey and white species. It has been found in Wales.

Family SPHASIDÆ.

A separate family has been made for a single transition-species Oxyopes lineatus, which unites three groups, the Lycosidæ, the Thomisidæ, and the Salticidæ. It has the principal characters of the first, the appearance of some of the second (Philodromus), and the habits of the third, of leaping suddenly on its prey.

o 19. OXYOPES LINEATUS (*Latr.*), Sphasus lineatus, *Bl.*—**19.** Enlarged figure.

It is light brown, with pale markings on the back, and black spots on the legs.

Family SALTICIDÆ.

This family derives its name from its habit of leaping on its prey (*Saltus*, a leap). They run with great velocity, and move sideways with ease. They are easily recognised by their oblong

CASE VII. form, the cephalo-thorax being massive, truncated in front with parallel sides, and large in proportion to the abdomen. Mr. Blackwall keeps the whole of the family in one genus, but other authors have sub-divided it into several genera, of which it will be sufficient to notice the more remarkable.

No. 20. EPIBLEMUM SCENICUM (*Clerck*), Salticus scenicus, *Bl.*—**20.** Enlarged figure.

Epiblemum scenicum (magnified twice).

This is the type of the family. A grey species with transverse oblique whitish bars on the back and legs, very common. When it springs upon its victims, it, by the act of leaping, draws from the spinners a line attached by its extremity to the station whence it took its spring; an arrangement which has been supposed to be a precaution against falling should it miss its aim.

No. 21. HELIOPHANES CUPREUS (*Walck.*), Salticus cupreus, *Bl.*—**21.** Enlarged figure.

Easily distinguished by its colouring and markings. The cephalo-thorax is dark brown and green with white markings behind; the abdomen dark green with a white margin in front, and four short transverse white lines on the back. Not common; found in Wales.

No. 22 BALLUS DEPRESSUS (*Walck.*), Salticus obscurus, *Bl.*—**22.** Enlarged figure.

A minute dark brown species; very scarce.

No. 23. SALTICUS FORMICARIUS (*Latr.*).—**23.** Enlarged figure.

Also very rare. It is remarkable from its great resemblance to an ant; a character possessed by several exotic species.

ECONOMIC ENTOMOLOGY.

BY

ANDREW MURRAY, F.L.S.

APTERA.

DIVISION II.—*HARVEST MITES, WATER MITES, TICKS, &c.*

Prepared at the request of the Lords of the Committee of Council on Education, and published for them

BY

CHAPMAN AND HALL, 193, PICCADILLY.

CASE VIII.

Order ACARINA, or MITES.

An easily observed distinction in structure between the scorpions, spiders, and mites, is, that the latter never have their abdomen segmented like the scorpions, nor pedunculated (that is, joined to the body by a narrow point of attachment) like the spiders. It is always in one piece, and united without any well-marked groove of separation to the last of the segments that bears the legs.

As a rule all mites have eight legs when mature, some indeed have their posterior legs atrophied and apparently absent, but traces of them can always be discovered, or their absence is an exceptional peculiarity. In their earlier stage they all have six. This statement may be made with confidence, for numerous species in every section and in almost every genus have been reared or observed, and in every instance the young were hexapod. The only apparent exception is the Phytopti, which in all stages appear to have only four, the two hinder limbs being absent; but, as we shall hereafter show, even this is in all probability only an apparent exception, not a real one.

The following is the arrangement which we propose for this order. It is very nearly the same as that generally adopted by naturalists, some few modifications, which recent researches seem to have rendered necessary, only having been made.

1. Trombidiinæ, containing—
   1. Tetranychi, spinning mites.
   2. Trombidiidæ, harvest mites.
2. Bdellidæ, snouted harvest mites.
3. Hydrachnidæ, water mites.
4. Gamasidæ, insect mite-parasites.
5. Ixodidæ, ticks.
6. Halacaridæ, marine mites.
7. Oribatidæ, beetle mites.
8. Acaridæ:—
   1. Hypoderidæ, subcutaneous mites.
   2. Hypopidæ, ichneumon mites.
   3. Tyroglyphiidæ, cheese mites.
   4. Sarcoptidæ, itch and louse mites.
   5. Phytoptidæ, gall mites.

We shall not go into any minute scientific description of the characters of these different mites; but they have hitherto been so little studied in this country that we feel sure we shall

CASE VIII. render an acceptable service to naturalists by giving a general resumé of the state of our knowledge regarding them in more detail than we shall do for any of the other orders of insects. We shall first offer a few hints which may be useful in assisting the reader, in a general way, to determine the place or genus of any species he may have in hand.

In the first place, the locality where they are found will be a great assistance.

The first section of the Trombidiinæ or spinning mites belong to the genus Tetranychus, or red spider of gardeners. These are found on plants, and are readily distinguished from their congeners by their very minute size, and by being semi-transparent; some species have little colour, and, to one unacquainted with them, might seem not unlike the cheese mites, but the form of their palpi and other characters, which will be found noticed as we go along, at once distinguish them from that group.

The Trombidiidæ, or harvest mites, are distinguished by their brilliant colouring, which is generally scarlet or some modification of red. Some, however, are marked with black or brown. They are usually found on the ground or under stones.

The Bdellidæ, or snouted harvest mites, have the same character of colouring, but are distinguished, among other things, by their mouth being protruded like a snout, and usually narrowed behind the palpi, giving them the appearance of having a head and neck, and still more by their palpi being bent at right angles in their midst like those of many weevils.

The Hydrachnidæ are merely Trombidiidæ converted into water mites, and adapted for their different spheres of life. They have the same general arrangements of structure, and retain the brilliancy of their colouring; some being as bright scarlet as the harvest mites, and others having a distribution of colouring still more startling.

The Gamasidæ are, for the most part, parasitic, chiefly on insects, but some on other animals, or ranging about free. They

CASE VIII. have often some peculiarity on their second pair of legs, such as being much enlarged or provided with hooks, &c.

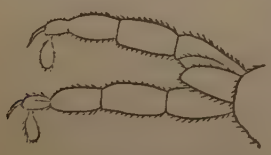
The Ticks, or Ixodidæ, are at once known by their leathery abdomen, by having a sort of shield on the back, immediately behind the head, and by their fastening on warm-blooded animals and sucking their blood, for which they have a specialized mouth-piece.

The Halacaridæ are marine, and the Oribatidæ have a chitonous skin, like beetles.

The Acaridæ are semi-transparent, and nearly colourless. The cheese mite section may be distinguished by having the skin smooth, and the tarsi usually terminated by a single claw with or without a sucker, which when present is not conspicuous. In the Sarcoptidæ the sucker is conspicuously the chief organ of locomotion, and the skin is always covered with more or less transverse lines or wrinkles. The Phytoptidæ also have the skin wrinkled, but only four legs, the two posterior pairs being replaced by bristles. They are excessively minute, and only found in buds or leaf-galls.

Family TROMBIDIINÆ.

Besides the general aspect and habits which we have already noticed, this group is to be distinguished by its palpi, which have



Palpi of Trombidium fuliginosum.

Typical palpus of Trombidium. Copied from Dugés.

generally the second joint longest, and the last bearing an appendage which with it serves to act as finger and thumb; sometimes it is like a claw, and at others is diminished to a hair, but is almost always present in some form, and usually easily enough distinguishable. It is however not absolutely confined to this family, similar appendages sometimes reappearing in the Gamasidæ.

CASE VIII. The types of this group are the red spider of our hot-houses, and the harvest mites of our fields. These form two distinct sections; the former consisting only of vegetable feeders, while there is little doubt that the latter are predacious and carnivorous. One would naturally expect from this that they should be easily distinguished from each other, and so for the most part they are, so far as general facies goes, the former being very minute semi-transparent, and not what is called very loud in their colours: white, pale yellow, pale orange, pale flesh colour, pale rust-coloured, or pale red; while the harvest mites are larger, velvety, and opaque, rarely semi-transparent, and of the most brilliant and decided colours, generally some shade of scarlet, vermilion, or red lead, varied sometimes with black.

Some species have seven joints in the leg, others only six; and Koch has used that as a distinctive character for separating a portion of the family from the rest. All have two claws to their tarsi; but the Tetranychi have them short, rigid, close together,

Claw of Tetranychus prunicolor. Copied from Dugés.

Claw of Trombidium holosericeum.

so as to look like a single claw, and much curved; the others not so much so. The woodcuts show the forms of these claws. The eyes have been used as a character, but they seem to have no more than specific value. The comparative length of the palpi and legs, as well as that of their different joints, has been more relied on, but this too fails to keep obviously allied species together.

CASE VIII.

Section I.—TETRANYCHIDÆ (Spinning Mites).

Genus Tetranychus (*Dufour*).

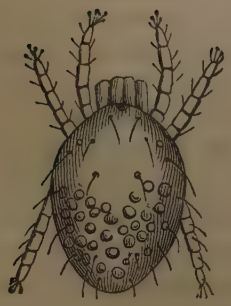
Legs with seven joints.

Tarsus of Tetranychus telarius. Copied from Claparède.

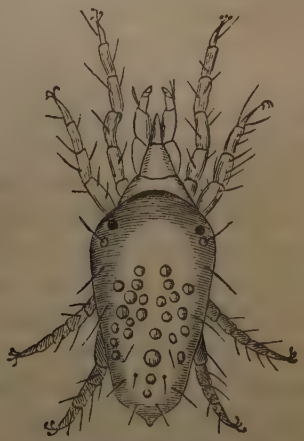
This genus shows a special affinity with its allies the spiders, some of the species at least being endowed like them with the power of spinning a web, for which purpose the claws of the feet are specially adapted, being very short and much curved, and provided with long stiff hairs, some of which have globular terminations, and are thought to be an essential part of the spinning apparatus. The mouth has a barbed sucking apparatus, and the palpi are chelate.

Mouth and palpi, and one mandible of Tetranychus telarius. Copied from Claparède.

Nos. 1, 2, 3. Tetranychus telarius (*Linn.*). The red spider. **1.** Magnified sketch of larvæ (with six feet). **2.** Ditto of perfect male (with 8 feet). **3.** Ditto of perfect female.



Tetranychus telarius; young state. Copied from Claparède.



Tetranychus telarius, perfect insect, male. Copied from Claparède.

CASE VIII.

This species has been found on a great variety of plants, and from its form and manners, it was supposed to be the same on all of them long before this had been proved by breeding them—a conclusion which could not have been arrived at had reliance been placed upon their colour, for some are greenish, and marked only with brown specks on the sides, but variable, and evidently dependent on the alimentary matter within them; others are rust-coloured, or reddish, or brick-red, and that is the colour with which horticulturists are most familiar. Upon the hollyhock Dugès found at the same time individuals presenting almost all shades of colour, a circumstance probably connected with some peculiarity in the nutrition derived from that plant. On the vine, Dr. Johnston found the colour to vary in intensity in different individuals. So far as our own observation goes, the rusty colour is an indication of greater maturity than the green. This, and most, if not all the species of the genus, spins a web on the back of the leaves of the finest and most delicate texture. The threads of its web are secreted from a conical nipple situated underneath, and very near the extremity of the abdomen. They are drawn out and guided by the motions of the insect, and by the action of the minute claws and hairs of the legs, which seem to be only used for this purpose. The threads are so slender that we fail to see them, even with the assistance of a magnifier, until after they are woven into a web, or network. In the construction of this web, all the feet are moved with great agility; but the movements of the mite itself are not quick, and it moves with difficulty over smooth and polished surfaces, as over glass. Upon leaves, especially on the under side of them, it finds a fitter hold, for, supported on the bristles that jut out beyond the claw, it spins its web, affixing the threads to the prominences and hairs of the

Tetranychus telarius (female). Copied from Boisduval.

CASE VIII. leaf; and under this shelter a colony, consisting of many of both sexes in maturity, and young in all their ages, feed and multiply with rapidity. The plant soon shows the influence of their presence in its sickly yellow hue: the sap is sucked by myriad insect mouths from the vessels of the leaf, its pores are choked by excremental fluids, and the gardener mourns the inefficacy of his remedies and the loss of his cherished flowers. The mode in which they feed is by eating their way into the leaf with their nipping mandibles (shewn in the woodcut), and then plunging in its barbed sucker and sucking the juice.

The egg of this mite is spherical, colourless, and proportionably large. The larva which comes from it is minute, transparent, and in shape not unlike the parent; but it has six legs only, and creeps very slowly. M. Dugès says that it undoubtedly passes through the immovable nymph or pupa state before the full complement of legs is acquired. M. Dugès believes that these mites pass the winter under stones, concealing themselves there when the infested leaves have fallen. In a garden near Paris he found several individuals thus concealed in the month of October; they were of a uniform brick-red colour, and had lost as yet none of their agility, nor of their spinning power; and on them he observed most distinctly the secreting papilla of the thread.

The leaves which are attacked have a languishing air; they are yellowish or greyish above, with some patches of a lighter shade, forming a kind of marbling; their edges are slightly folded back, and as if they were slightly rolled on the under side; the lower side is whitish and slightly shiny.

If in that state we examine with the microscope the under side of a leaf, we find hundreds of individuals of all ages, as well as the eggs, pasted to the warped stuff on the leaf.

The remedies that have been found by our horticulturists most effectual against such enemies as the red spider are various preparations of soap, sulphur, and quassia water; sulphur being the active principle and most efficient agent. Gishurst Compound,

CASE VIII. Veitch's Chelsea Blight Composition, Frettingham's Liquid Compound, are all good. Sulphur, in any form, seems potent. Laying flour of sulphur upon the pipes in the greenhouse or hothouse is much recommended. It has been used with very decided success also against the growth of microscopic fungi, as in the case of the Oidium Tuckeri (vine fungus). Mixed with soap, as is done in Gishurst Compound, and applied to the leaves by the syringe, it is also very useful. Even plain soap and water is said to be an effectual remedy if it reaches the insect. A quarter of a pound of soft soap whisked until it has become dissolved, is to be applied with the syringe so as thoroughly to wet the leaves; but in watering and bathing the leaves, we must remember that if we content ourselves with watering the upper side of the leaves we have done nothing, because the mites remain very quiet during the operation and in perfect security on the lower side. It is necessary, to secure success, to use a bent syringe to send the water upwards, and to wet the under side of the leaves well with the decoction used.

The gardener is assisted in his war against them by other mites and insects, that help to keep them in check by preying on them. The grub, or larva, of the Hemerobiidæ, or lace-wing flies (the same which prey on the Aphides), devour them in such numbers and so fast that entire colonies quickly disappear before them.

TETRANYCHUS TELARIUS *Var.*; CINNABARINUS (*Boisd.*), Ent. Hort., p. 88.

We can see nothing in the following account of this species, which is from the pen of M. Boisduval, to distinguish it from the red spider, Tetranychus telarius:—

"It was in the warm greenhouses of M. Savage that we became acquainted with this acarus on the tufts of Dracæna australis. Thanks to that able horticulturist we have been able to observe it from the egg stage to that of the perfect insect. When it hatches it is then green or a yellowish green; later it is variegated with black and green; after its last change of skin, it becomes a beautiful aurora red in colour. It is a little larger

CASE VIII. than that of the camellia; it carpets the under side of the leaves of the Dracæna with threads of silk, on which it walks like a spider. It does a great deal of harm to the leaves that it sucks, stopping their vegetation and causing them to become diseased. It is not difficult to destroy them; to do so it is sufficient to place the plants attacked by this vermin in a cold house during two or three days. M. Savage brought us a Dracæna australis on which these parasites could be counted by hundreds. It had scarcely remained twenty-four hours in our cabinet, when all had disappeared; the change of temperature had completely killed them." The only specific character here given is the colour, which, as we have already said, varies much in the red spider.

The following for the same reasons does not appear any better entitled to rank as a separate species.

TETRANYCHUS TELARIUS *Var.*; HÆMATODES (*Boisd.*), Ent. Hort., p. 88.

M. Boisduval says that this little parasite was observed by M. Rivière on the leaves of the red variety of the Ricinus (Ricinus communis), frequently cultivated now-a-days in the squares and gardens of Paris.

It is rounded oval, of a deep blood red; it spins under the leaves, between the divisions of the first nervures, a slack tissue like little spiders' webs. It is very small, and only visible with a strong magnifying glass. M. Boisduval suggests that his hæmatodes approaches a good deal to the Raphignathus ruberrimus, which Dugès discovered under stones, and which he described as a new species; but there is nothing in his description that supports this except the colour, and that may depend on the food-plant.

TETRANYCHUS TELARIUS *Var.*; TINI (*Boisd.*), Ent. Hort., p. 91.

The laurustinus, which grows naturally in the south of France, and those which are cultivated in the gardens of Paris, are subject to a kind of grise, as it is called, occasioned by a little reddish mite, which multiplies in a prodigious way on the under side

CASE VIII

of their leaves. M. Boisduval calls it Acarus tini, but we see nothing in his description to distinguish it from telarius.

M. Boisduval, in his "Entomologie Horticole," also mentions, without much description, a number of other Acari, which he thinks have probably been erroneously confounded with telarius, but which from their different forms and habitat he regards as distinct. The above, in our opinion, do not differ from that species. Others we have allotted elsewhere. As to the following we are in doubt, although it seems not improbable that they too, or at least some of them, may be merely varieties of T. telarius.

TETRANYCHUS CUCUMERIS (*Boisd.*), Ent. Hort., p. 84.

This mite lives on the cucumber and the gherkin; it is more globular than telarius, a little smaller, of a uniform shade. In some years it is common enough in the kitchen garden. When the Cucurbitaceæ are attacked by the grise, the best plan is to take out the sick plants. We must not confound the grise with a species of Mycelium, a kind of Erysiphe, which forms milky white spots on the leaves.

TETRANYCHUS ROSARUM (*Boisd.*), Ent. Hort., p. 84.

This, according to Boisduval, is more elongated than the preceding ones, and is of a very pale green colour, almost transparent; it lives under the leaves of certain varieties of rose trees, and is found sometimes alone, and sometimes together with another little red mite which he designates under the name of Acarus pucciniæ.

He says that he never met with these two Acarids but on diseased leaves, of which the lower surface was covered by the Uredo rosæ and the Puccinia rosæ growing pell mell one beside the other. They seemed to be living at the expense of these two hypophyllous fungi. The rose leaves invaded by these two vegetable parasites are underneath of a yellow-ochre colour besprinkled with large brown dots; on the upper side variegated with spots and marblings of different colours, in which we may sometimes see the little larvæ of a tenthredo eating the parenchyma.

CASE VIII. TETRANYCHUS FERRUGINEUS (*Boisd.*), Ent. Hort., p. 90.

This mite lives in greenhouses on the Cyclamen Coum and persicum, and often makes great ravages. It pricks the leaves underneath, beginning at the base of the petioles. When these are attacked by the little insect they take a violaceous or reddish hue above; their vegetation is stopped, they fade and fall. In examining them with the glass, the underside is seen to be covered with small blackish dots caused by the prickings of this microscopic parasite. It is excessively small, of a more or less dark ferruginous red. When the cyclamen begins to be attacked, which can be seen at the first glance, the only remedy, according to M. Boisduval, is to lift the pots and burn the tubers in order to prevent these little beings spreading over the neighbouring plants. Flower of sulphur has been tried as a remedy with little success.

TETRANYCHUS RUSSULUS (*Boisd.*), Ent. Hort., p. 89.

This is a little mite mentioned by M. Boisduval, which he thinks has probably been imported from Mexico, or from some other country of Central America. It is only found on cacti, particularly on the mamillaria, the echinocactus and neighbouring kinds, and is known to amateurs of succulent plants under the name of *rouget*. It is ferruginous red and almost microscopic, and does much damage to the plants on which it establishes itself, and if remedies are not promptly applied, it soon destroys them.

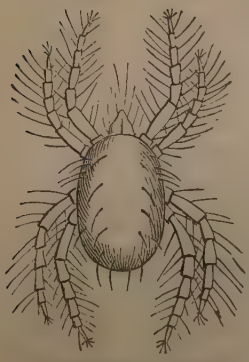
Fumigations of tobacco, or powdering the plants with it, have been used in such cases with success.

TETRANYCHUS VITIS (*Boisd.*), Ent. Hort., p. 92.

M. Boisduval gives the following description of this species:—

"When towards the end of summer we see the leaves of the vine marbled above with broad yellow blotches, it is often the indication of the presence of a very small parasite, which lives in family on its under side. On examining such a leaf with a very powerful lens, we see at first that it is carpeted with a rather loose

CASE VIII. silken tissue like very small spiders' webs, in the midst of which we can see numerous Acarids of very small size moving about. They are greenish yellow, transparent, a half smaller than the Tetranychus telarius, to which they bear some resemblance. We have not found this minute insect mentioned in any of the authors that we have consulted. Can they have confounded it with that which produces the 'grise' (the red spider, T. telarius)? It is extremely unlikely, because the red spider clothes the under side of the leaves with a close tissue which adheres very closely, while this species spins a very loose web like that of a spider. For gardeners this malady is a species of 'grise.' As it only appears towards the end of summer, it does not do much harm to the ripening of the grape or to the vine itself."



Tetranychus lintearius (copied from Dufour's figure).

No. 4. TETRANYCHUS LINTEARIUS (*Duf.*, Ann. Sc. Nat. 1832). Acarus coccineus, *Schrank* and *Boisd.*, Ent. Hist., p. 87? **4.** Magnified sketch of ditto.

M. Dufour was the first who observed this species. He lived in the suburbs of St. Sever, and in the course of his rural excursions, his attention was often drawn to clumps of gorse (*Ulex Europæus*) some feet in diameter, which he found enveloped completely in a spider's web of milky or opaline white, which was visible from a distance. He describes it as being exactly as if a web of fine muslin had clothed this thorny shrub in every direction, and penetrated by adherent folds into the space between the branches. In spite of repeated poring over these tufts to discover the artificers of this delicate tissue, they eluded his researches for a long time. He sometimes met here and there upon them various spiders, such as Epeiræ, Linyphiæ, Uloboræ, and Dolomedes; but he was too familiar with the works and the kind of life of these Araneides to allow himself

CASE VIII. to suppose that it was produced by them, and he remained thus several years without being able to resolve this entomological problem. At length, during the autumn of 1830, which was remarkable for the long continuance of fine weather, these white webs being still more numerous than usual, he again took his place of observer. He then perceived upon this web a kind of red dust, sometimes disseminated, sometimes gathered together, or agglomerated. He at first took this for inert or excremental molecules. But the magnifying glass came happily to dissipate this illusion, and crown his wishes, for it showed him that these red dots were living. The extreme abundance of these animalcules, for there were thousands of them, made him presume that they were the makers of the tissue which supported them, and his presumption was soon changed into certainty. He shut up in cornets of paper crowds of these little Arachnides, in order to examine them in the silence of the study by the aid of the microscope. Scarcely had he placed them in a little glass bottle, than they began to separate, to scatter, to examine their new habitation, and at the end of two hours, there were already some hundreds of these workers established on a web, and working under his eyes with ardour. Some were placed under the web in such a way as to present the under side of the body to the observer, others were above it; some went down, some came up; he often saw them cross each other obliquely, but far from running against each other, from entangling themselves, they mutually yielded the way, so that no gap, no fault in the fabrication of the web resulted.

He found that the tissue fabricated by these myriads of pigmy weavers was not a net or thread, but a fine and well-joined web. The threads of this are a little oblique to the horizon, and cross at very pointed angles. When their cloth is finished, they keep themselves generally under it, as if to put themselves in shelter from the direct influence of surrounding bodies. He satisfied himself that the thread which they emit comes from underneath the abdomen, and probably from imperceptible papillæ. But he

CASE VIII. was not able, owing to the diminutive size of these Acarides, to establish the fact of their existence by direct observation. He could not ascertain what they fed on; but their great numbers indicate that they, like their congeners, are herbivorous. Animals that are social are very rarely predaceous.

M. Lucas mentions (Ann. Soc. Ent. Fr., 1869) that it is much rarer in Normandy than in Brittany, whence it may be doubted whether it is likely to be met with in this country. Being desirous of carrying off a souvenir of this able weaver, he cut some branches of gorse on which a few millions of this species had established themselves, and, putting them in a box, the mites set themselves to spin a web of milky white, which he exhibited to the Entomological Society of France, and he draws attention to its thickness and its extreme delicacy and fineness, and its quality of not adhering to the touch, justifying entirely M. Leon Dufour's comparison of it to a piece of the finest muslin.

In the environs of Marseilles, where the camellia is cultivated on a great scale, the underside of the leaves is often observed to be disfigured by white spots or blotches. M. Laboulbène (Ann. Soc. Ent. Fr., 1865) ascertained that these were caused by Tetranychus lintearius. The largest individuals are scarcely the third of a line in length, obtuse, oval in shape, of a vermilion red, more or less intense, and with the legs pale, one or two obscure patches on the back at the sides, two or four ranges of long white hairs run down the back. In the fresh individual, in which the body is plump and the skin well stretched, no trace of a division between abdomen and thorax is visible, but when somewhat shrunk a slight constrictive division becomes visible. M. Dufour gives a figure of this species, which we have copied, although we do not think it has the look of being a good portrait.

M. Boisduval observed it under the leaves of the syringa or sweet pipe. It is possibly, too, the same species that is noticed by him under Schrank's name of Acarus coccineus. He says that it makes a tapestry of fine silk, very light, to which the dust sticks,

CASE VIII. on the upper side of the leaves of the camellia. It is of a deep red, of an oval form, and reddens the fingers when one crushes it. If after having cleaned the leaf, where it has established itself, one examines it, one sees that it is pricked from place to place, and that the points where this little parasite had inserted its sucker had become of a reddish colour. He observed it in the autumn in several gardens on the camellias, and also on some other plants of the greenhouse.

No. 5. TETRANYCHUS *Sp.*—**5.** Magnified sketch of ditto.

This is a species which we found inhabiting a slightly decayed crack in the twig of an oak-tree. It has several points of resemblance with T. telarius, but is not dull or downy-like in texture like it, but somewhat shiny. It was rubicund, transparent, and had a dark patch on each side, and an indistinct division between the thorax and abdomen. It may, however, only be a variety of telarius, and we have therefore refrained from proposing a name for it.

Nos. 6, 7. TETRANYCHUS FICI (*Murr.* n. s.).—**6.** Sketch of leaf attacked by ditto. **7.** Enlarged sketch of insect.

Found in great numbers on the leaves of fig-trees, near London, probably imported. It is ovate, dull yellowish, and not glabrous or very transparent.

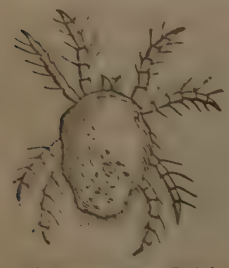
Nos. 8, 9. TETRANYCHUS TILIARUM (*Mull.*), Flexipalpus tiliarum (*Scheuten*).—**8.** Enlarged sketch of ditto. **9.** Lime leaf covered by ditto.

Claparède considers this species to be only a variety or synonym of T. telarius. We have not met with it since we learned that this was his opinion, so as to subject it to a careful comparative examination; but our remembrance of a more superficial examination some years ago is opposed to their identity. It especially attacks the lime tree, but it is not confined to it, having done considerable mischief to many crops in France in 1874—as French beans, cucumbers, and melons. It is a minute yellowish or orange-coloured species; and it occasionally occurs in such numbers as almost to denude the trees of their foliage; and it has been noted

CASE VIII. that the stems and branches of such trees seemed covered with a bright glaze. Can this be a fine web? It is similar to the red spider in form, but a trifle smaller, more elliptical, slightly broader in front, and pale whitish yellow instead of reddish. Like it, it is semi-opaque and velvety, the contained food being at times visible through the skin. The figure here given is a magnified representation of it. It covers the under side of the leaves with a slight web of silk, which gives it a brilliant surface. On this the mites move about with a good deal of quickness. They do not gnaw or eat away the leaves. Like their fellows, they merely suck the juice of the leaf; but although almost microscopic in size they make up for their minuteness by their numbers, and under their attacks the leaves rapidly shrivel up and die. They chiefly congregate on the under side of the leaf, those found on the upper side being mere wanderers, while on the under side they are sometimes crowded together in vast numbers; for example, we have seen them so thick on the leaves that they looked as if they were not merely sprinkled with a yellow orange-coloured powder, but as if it was actually in parts heaped up on them, so that none of the green colour of the leaf was visible. Their appearance in such excessive numbers is said to follow certain peculiar states of the atmosphere.

Tetranychus tiliarum. The Lime Tree mite.

No. 10.



Tetranychus socius. Copied from Hermann.

TETRANYCHUS SOCIUS (*Herm.*), Acarus sociarius, *Mull.*—10. Enlarged figure of ditto.

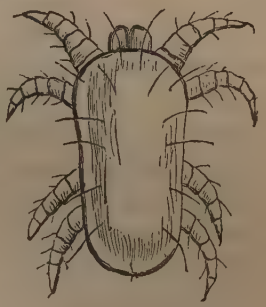
This species also is regarded as a synonym of T. telarius by Claparède, as to which we give no opinion. It was first described by Hermann, and the most prominent character given was that the palpi

CASE VIII.

stand facing a little outwards, so as to make the mouth look emarginate. It is semi-transparent, with a faint blush of flesh-colour.

The eggs of these mites are garnet-red in colour, and are to be seen early in the spring on the young buds of clover. The larvæ which are out spread themselves over the hairy underside of the leaves, which, in consequence of continued sucking, become covered with yellow punctures.

In buds injured by Phytopti we have found in place of them, in July, what we suppose to be this Tetranychus; but instead of hundreds in a single bud we have only met one or two here and there.



Tetranychus eriostemi.

Nos. 11, 12, 13, 14, 15.

TETRANYCHUS ERIOSTEMI (*Murr.* n. s.).—**11.** Specimen of leaves of Eriostemon neriifolium attacked by ditto. **12.** Magnified sketch of leaf showing the mischief. **13.** Twig showing mischief on ditto. **14.** Magnified sketch of ditto. **15.** Magnified sketch of insect.

This species is found on plants of Eriostemon neriifolium in greenhouses in the neighbourhood of London, and, no doubt, elsewhere. It injures the plant considerably, making unsightly ulcerous-looking scars on the stems and branchlets, and white blotches on the leaves. It is a more clumsy thick-legged species than the others.

Nos. 16, 17

TETRANYCHUS AUTUMNALIS (*Shaw*) (the harvest bug—le rouget of the French; the Leptus autumnalis of authors); **16.** Magnified figure of larva. **17.** Magnified figure of perfect insect on under side.

Tetranychus (Leptus) autumnalis larval form.

Until Claparède drew attention to the fact, that all the characters of this species were those of a Tetranychus, it was generally regarded as a Trombidium—and in

CASE VIII.

its six-legged stage as a Leptus—we think that any one who examines the palpi will acknowledge that Claparède is right, and the wonder will rather be how it ever came to acquire a settlement among the Trombidii.

It is of a brick-red colour, and is so minute as to be scarcely visible to the naked eye. Though bred upon plants, such as French-beans, currants, raspberries, gooseberries, and other vegetables, yet it deserts them whenever opportunity presents itself to fasten on animals, and it has apparently a particular predilection for the human species, especially women and children. They fasten upon their skin, chiefly where any part of the dress fits closely, adhering by their claws and palpi so firmly, that when once fixed they can scarcely be detached without violence. When disengaged their motion is quick, though not so rapid as that of some other species of mites. On the part where one of them fixes it causes a tumour, generally about the size of a pea, sometimes much larger, accompanied with severe itching. The point of a fine needle is best calculated for removing them with the aid of a magnifying glass. Different persons suffer in different degrees from these attacks, and some persons they pass over altogether. For instance, a case is mentioned (see notes to White's Natural History of Selborne, Brown's Edition (9th) p. 113) of two persons who had been together during a day's nutting in the woods, and who afterwards slept in the same bed-chamber, one of whom was entirely covered with red blotches from the attack of this mite, while the other was untouched. White also, when mentioning their uncommon abundance in the chalky districts of Hampshire, relates that he had been assured, that they swarmed to so infinite a degree in the rabbit warrens on the Downs, as to discolour the nets of the warreners, and give them a reddish tint, whilst the men were so bitten as to be cast into fevers.

In some parts of Scotland (East Lothian for example) we have known them so numerous and troublesome in the fruit gardens as to deter ladies and children from gathering gooseberries. The

CASE VIII. late Dr. Johnston of Berwick also mentions (Acarides of Berwickshire, in "History of Berwickshire Naturalists' Club," p. 221) that in Berwickshire this mite was very troublesome to horses, cattle, sheep, dogs, and rabbits, and to the "herds' bairns," and people engaged about the infested animals in that county. It adhered to the skin, and in numbers occasionally so great as to be collected into small clusters, hanging like a drop of congealed blood from the hairs. They produced extreme itchiness; and his correspondent says, "in the worst case I have seen, that of a horse, the skin seemed exactly as if it had been rubbed with a liquid blister." Hence he inferred that the mite had penetrated beneath the skin, as it is known that it easily does into that of man. When examining it, some individuals got upon his hands, over which they dispersed themselves with considerable quickness, and in a few seconds they had burrowed in the skin so deep as not to be perceived, but the place in which they had burrowed was indicated by itchiness, and by a blister that exactly resembled the pustule occasioned by the sting of a nettle. One individual was watched. Its race over the hand and the moment of its fixation was unfelt; neither was any uneasiness felt by its penetration of the skin. On getting under the cuticle it was killed by a strong squeeze. No itchiness ensued, nor blister, and the dead insect remained after an interval of more than three months unaltered, the red speck then still marking the spot of its death and burial. Latreille compared the symptoms to those of the itch. M. Greeby calls the affection the autumnal erythema; M. John has observed an exanthema due to this cause; and M. Moses cites a case of vesicular and papillar inflammation, with unsupportable itching produced in a family by this insect. Perhaps its effects are more severe in France, where these cases occurred, than in this country. M. Megnin says that the insects are got rid of by means of sulphur ointment, by friction with benzine and oil of petroleum or phenic acid, which we may say in passing are also common remedies for the itch.

And here we may put the question. What do these little creatures

CASE VIII. do when they burrow under the skin? Do they suck the blood or not? Some entomologists of eminence have thought so; and certainly the Trombidii have a double tubular sucker, and no doubt can do it if they choose.

This troublesome insect most prevails near the sea-shore, where the soil is light. It begins to appear in the early part of July, and is very troublesome in August. Then great numbers may be observed crawling upon and over all green things,—on turnips, grass, and corn. Cats suffer greatly from them through their prowling habits in gardens, so much so, that they are sometimes thought to be suffering from the itch, when it is only from daily reinforcements of this tick. It can always, however, be easily distinguished from the itch insect. It attacks the cat's head, while the harvest mite has no particular point of preference, but is naturally found chiefly on the feet and legs, which are most exposed to it.

When examined under the microscope, the lower part of the body appears to be coated with stiff bristles. It is provided with a tubular snout, formed by the two mandibles, which is generally concealed or sheathed, but which may sometimes be distinctly seen. On the top of the head are two little processes, or sharp implements, which turn outward each way.

The larval form is that in which this species is generally encountered; and, although it has for long been supposed that it was merely the larva of a similar mite, yet it is only a few years since the fact was determined by direct observation. This, however, has now been done, and we find a figure of the perfect eight-footed insect, in "L'Insectologie Agricole" (1868), by M. Megnin, who observed them.

Kirby and Spence mention a similar insect which occurs in Brazil, abounding in the rainy season, particularly during the gleams of sunshine or fine days that intervene, as small as a point, and moving very fast. These animals, say they, get upon the linen and cover it in a moment; afterwards they insinuate themselves into the skin, and occasion a most intolerable itching.

CASE VIII. They are with difficulty extracted, and leave behind them large livid tumours, which subside in a day or two. An insect very tormenting to the woodcutters and settlers on the Mosquito shore and Bay of Honduras, and called by them the Doctor, is thought to be synonymous with this. They add, on authority which they give, that more serious consequences have been known to follow the bite of another mite related to the above, if not the same species, common in Martinique, and called there the bête rouge. When our soldiers in camp were attacked by this animal, dangerous ulcers succeeded the symptoms just mentioned, which in several instances became so bad that the limb affected was obliged to be taken off.

TETRANYCHUS TLALSAHUATE (*Lemaire*).

To this irritating group also probably belongs a small insect that occurs in Mexico, called by the Indians Tlalsahuate. It lives among the herbage, and is almost imperceptible to the naked eye. It attacks man, and fixes itself upon the eyelids, or armpits, &c. Its presence is announced by an itching sensation on the part where it is, which is followed by redness, swelling, and sometimes suppuration. These morbid phenomena usually last for six days, and always remain local, which would seem to indicate that the insect does not propagate. All that is required, in order to get rid of the morbid sensations, is to remove the insect. This is done by the Mexicans by a needle or fine stalk of grass. The insect appears only to occur in the temperate lands of Mexico, being unknown in the hot regions. An instance is recorded in the "Annales de l'Académie des Sciences," (1867), of its importation into France. "On Saturday last (15 July)," says M. Lemaire, who reports the circumstance, "Madame Biart brought me her daughter, about four years of age, who complained of a smart itching in the eyelid of the left eye. I found there, between the eye-lashes, some redness and swelling. From the information given me, it occurred to me that this might possibly arise from the

CASE VIII. Tlalsahuate, inasmuch as M. Biart, who had passed a long time in Mexico, had recently received numerous boxes from thence, the packing and contents of which had remained for a good while close to the lawn on which his children habitually played. I, therefore, looked for the insect, and, by the assistance of a magnifying glass, discovered it fixed between two eye-lashes in the middle of the redness. Its form is oblong and its colour bright orange yellow. M. and Mdme. Biart, who had been familiar with it in Mexico, at once recognised it." The specimen was unfortunately dropped and lost, so that we are still without a scientific description of it.

It is possible that this species may have some relation to that in a case quoted by Kirby and Spence, from Sir Joseph Banks, who, in a letter to Dr. Adams, related that some seamen belonging to the *Endeavour* brig being tormented by a severe itching round the extremities of the eyelids, one of them was cured by an Otaheitan woman, who, with two small splinters of bamboo, extracted from between the eyelashes abundance of very minute lice, which were scarcely visible without a lens, though their motion when laid on the thumb was distinctly perceived. Older authors quote similar phenomena, but as their knowledge of the subject was imperfect, and we cannot cross-examine them, it is perhaps best to ignore them.

No. 18. TETRANYCHUS TROMBIDINUS (*Dug.*, Ann. Sc. Nat. 1834. Trombidium glabrum, *Dug.*, Ann. Sc. Nat. 1834).—**18.** Enlarged figure of ditto.

This has all the appearance of a Trombidium, but it is smooth and not velvety, and M. Dugés found that it had two spinning papillæ behind.

Genus RAPHIGNATHUS (*Dugès*).

Tarsi thick, palpi long, and mandibles sharp-pointed.

No. 19. RAPHIGNATHUS RUBERRIMUS (*Dug.*, Ann. Sc. Nat. 1834).—**19.** Enlarged figure of ditto.

This is a Tetranychus, with long palpi instead of short ones,

CASE VIII. which seems the chief character of Dugés' genus Raphignathus. The structure of the mouth is adapted for living on plants.

Raphignathus ruberrimus. Copied from Dugés.

M. Dugés found, moreover, in the hinder part of the body, two papillæ adapted for spinning. We have no hesitation therefore in regarding Raphignathus as belonging to the Tetranychidæ.

Tetranychus ruberrimus is of a bright red colour, but smooth. Dugés found it frequently under stones and in shady places, but it doubtless would also be found on plants at the proper season.

Raphignathus ruber. Copied from Koch's Übersicht.

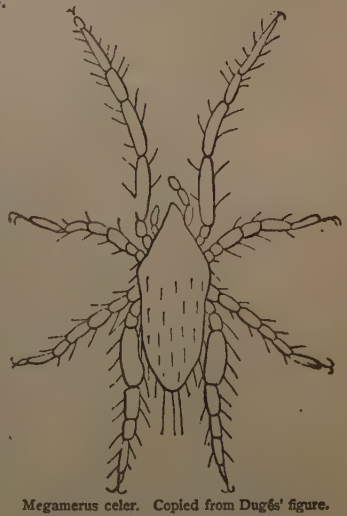
RAPHIGNATHUS RUBER (*Koch*, Ubers.).

Described by Koch first under the name of Caligonus ruber.

Genus MEGAMERUS (*Dugés*).

A genus, established by Dugés, of which the more important characters are, that the palpi are long, the mandibles provided with nippers, and the hind thighs enlarged.

The Megameri live in numerous families, running swiftly and occasionally leaping, which their large hind thighs enable them to do· and they appear to spin a



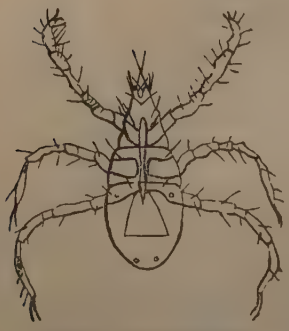
Megamerus celer. Copied from Dugés' figure.

CASE VIII. network of fine threads of silk, in which they suspend themselves. M. Dugés says that some of them are certainly carnivorous; but there are some, the green colour of whose intestines indicate a vegetable diet. The larvæ, like those of all the others, have been proved to be six footed. He places the genus among the Trombidii; but its spinning qualities seem to show that its proper place is with Tetranychus, with which its other characters do not disagree.

No. 20. MEGAMERUS CELER (*Dug.*, Ann. Sc. Nat., 1834).—**20.** Magnified figure of ditto.

SPECIES INCERTÆ SEDIS.

No. 21.

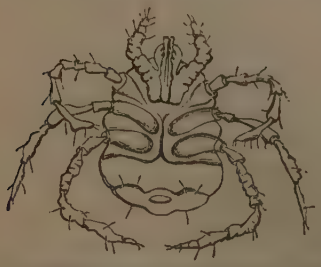


Tetranychus? (Leptus) Americanus. Copied from Mr. Riley's figure.

TETRANYCHUS? AMERICANUS, young (Leptus americanus, *Riley*, Sixth Ann. Rep. Missouri, 52).—**21.** Magnified sketch of ditto, copied from Mr. Riley's woodcut.

Mr. Riley states that this species is found along with Leptus irritans in North America, and that both are there called Jiggers, or harvest mites. They are red like their congeners. Our information regarding both is insufficient to enable us to fix their place.

No. 22. TETRANYCHUS? IRRITANS, young (Leptus irritans, *Riley*, loc. cit. supra).—**22.** Magnified sketch of ditto, copied from Mr. Riley's woodcut.



Trombidium (Leptus), irritans. Copied from Mr. Riley's figure.

This is the Jigger of the Mississippi valleys, where it is exceedingly irritating—whence its name. It acts as one of the representatives in that country of our Tetranychus (Leptus) autumnalis; but until the perfect insect is known its place must be conjectural.

CASE VIII.

SECTION II.—TROMBIDIIDÆ. (Harvest mites.)

M. Dugés divides this section, like the last, into two subsections, according to whether the tarsi are long or short, and makes further generic divisions depending upon whether the mandibles are hooked or pointed, and upon differences in the claws of the feet.

Koch has divided the whole of the Trombidiinæ, including Tetranychus, into two groups; the one having seven joints in the leg, the other only six, and he has used the comparative length of the legs, and the presence or absence of a line of separation between the cephalothorax and abdomen as characters for further subdivision. We have disposed of Tetranychus, and shall now for the remainder of the family borrow what seems best from each of the above authors, and propose the following system of arrangement :—

1. Subsection. Legs composed of six joints (Eupodidæ of Koch).
   - A. Cephalothorax distinguished from abdomen by a more or less distinct line of separation. BRYOBIA, PETROBIA, TYDEUS, EUPODES, PENTHALEUS, SCYPHIUS.
   - B. Cephalothorax not distinguished from abdomen by a line of separation.
     - § Anterior legs exceedingly fine and long. LINOPODES.
     - §§ Anterior legs normal. PENTHALODES.
2. Subsection. Legs composed of seven joints.
   - C. Cephalothorax distinguished from abdomen by a line of separation. STIGMÆUS, CALIGONUS.
   - D. Cephalothorax not so distinguished. TROMBIDIUM RHYNCHOLOPHUS, SAMARIDIA, PACHYGNATHUS, ERYTHRÆUS.

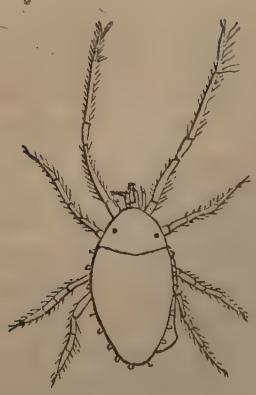
We shall briefly notice and figure each of these genera.

1ST SUBSECTION.

Genus BRYOBIA (*Koch*).

Anterior legs longer than the others. Eyes moderately large, near the hinder angles of the cephalothorax. The margin of the abdomen is studded with short, somewhat triangular, widely separated papillæ.

CASE VIII.



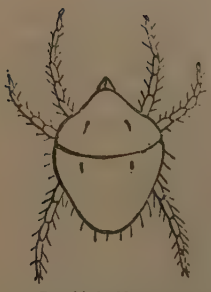
Bryobia speciosa. Copied from figure in Koch's Übersicht.

BRYOBIA SPECIOSA (*Koch*), Ubers., 61.

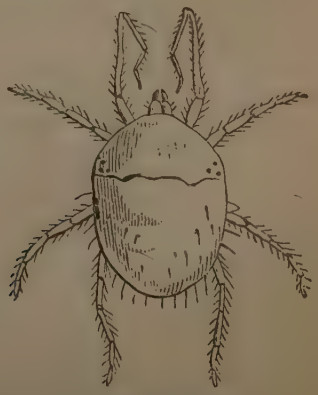
Genus PETROBIA (*Murr.*, n.g.).

Characters the same as those of Bryobia, but with three eyes in the posterior angles of each side of the cephalothorax, and abdomen without triangular marginal papillæ. Dugés hesitated whether to place the species from which we have named this genus among the Tetranychi or Raphignathi. It appears to us to come so near Bryobia that it would not be well to place it apart from it, and yet too different to be put in the same genus. We have therefore thought it better to make a separate genus for it.

Nos. 23, 24. PETROBIA LAPIDUM (*Koch*). Trombidium lapidum (*Herm.*, Apt. pl. vii.); Tetranychus cristatus (*Dugés*, Ann. Sc. Nat. 1834).—**23.** Magnified figure of larva. **24.** Magnified figure of perfect insect.



Petrobia lapidum, young.



Ditto, full grown.

This is easily recognised by a sort of crest or ridge which crosses the back like a girdle, as shown in the woodcut. It, however, disappears when the insect is very well filled. The presence of

CASE VIII. three eyes in a triangular cluster in the posterior lateral angles of the thorax is a good character, but Dugés failed to see these eyes. Should there prove to be any error about them, and should the marginal papillæ on the abdomen of Bryobia not be present in all the species of that genus, then there would be nothing to prevent this species taking its place among them; or for that matter, if we once begin to speculate on the possibility of errors in the figures, there is not much to say against its being the same species as the preceding Bryobia speciosa, or the following Tydæus mutabilis. Without some special ground of suspicion, however, this is not warrantable and we must act according to our lights. The young is rose-red, the perfect insect varies from dirty red to dark brown, with a tinge of red with some white spots on the back and on the margin. Its anterior legs are much longer than those of the young. The male is smaller and redder than the female. Dugés found isolated individuals on many plants and under stones. In the south of France he found it in families in the light down which clothes the under side of the leaf of the plane-tree. In autumn he found it under the stones in the public walks, in entire families, which led him to think that, at that season at least, it quitted the trees in order to multiply more securely. In this country, Mr. Albert Müller mentions (*Entomological Monthly Mag.* 1867-8, p. 71) that it occurred when he wrote (August) in countless numbers on the flint gravel covering the approaches to Elmer's End Station, near London.

It is also probably this species to which the following notice in Cooper and Busk's *Microscopic Journal* refers. The pebbles of the gravel, say they, on Blackheath and the neighbourhood were at the time they wrote abundantly covered with the ova of the Acarus lately described by Mr. White, and formerly considered as a fungus under the name of Craterium pyriforme. Before the late rains these bodies were to be seen on pieces of wood, and many other substances, as the stalks of plants, etc., as well as on the pebbles. They add that they had seen specimens of the same deposit on

CASE VIII.

pebbles from Lincolnshire, and from Devonshire or Cornwall in the neighbourhood of Plymouth, from which it would appear to be very generally distributed throughout the country.

Tydeus mutabilis. Copied from figure in Koch's Ubersicht.

Genus TYDEUS (*Koch*).

Similar to the preceding, but without eyes. The anterior legs only slightly longer than the rest. This species is very minute, being no larger than a fine pin's point.

TYDÆUS MUTABILIS (*Koch*), Ubers.

Found in damp moss, or on moist earth. Koch has described thirteen species of Tydæus.

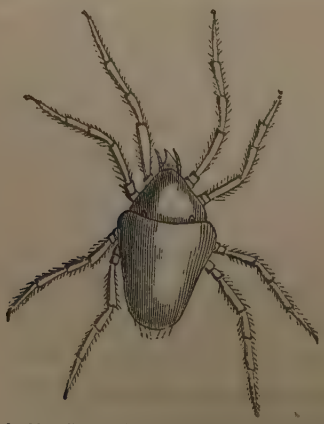
RHAGIDIA GELIDA (*Thorell*, Oefv. Sv. Ak. xxviii. 700, 1871).

This is a new genus and species described by Thorell from Spitzbergen. He says it belongs to this section, but gives no figure of it or its characters.

Genus EUPODES (*Koch*)

Shoulders of abdomen prominent. Eyes on the posterior margin of the thorax.

EUPODES HIEMALIS (*Koch*, Ubers.).—Size, a small pin's head.



Eupodes hiemalis. Copied from figure in Koch's Ubersicht.

CASE VIII. Nos. 25, 26.

EUPODES CELER. (Trombidium celer, *Herm.*, Apt.)—**25.** Magnified figure of larva; **26.** Ditto of perfect insect.

Eupodes celer, young. Copied from Hermann's Mem. Apt.

Ditto, perfect insect. Copied from Hermann's Mem. Apt.

The larva is scarlet, and the perfect insect pale brown. M. Dugés placed this among the Tetranychi, but we think the figure of the perfect insect will justify our having placed it here. Koch has described twenty-eight species. They are found in damp moss and under stones, &c.

Penthaleus hæmatopus. Copied from figure in Koch's Übersicht.

Genus PENTHALEUS (*Koch.*).

Somewhat elongate. Anterior legs rather slender and long, and the posterior thighs thickened.

PENTHALEUS HÆMATOPUS (*Koch*).

Koch divides this genus into three sections, which should probably represent as many genera. In the first the legs are filiform (eight species), in the second gradually thickened towards the extremity

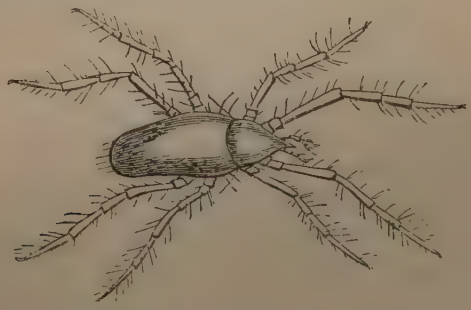
CASE IX. (two species), and in the third there is no line of separation on the back between the thorax and abdomen (two species). In this latter Koch includes Dugés' Megamerus ovalis. Our arrangement, however, will not admit it here, and we have made a new genus for it elsewhere. It is exceedingly minute.

Thorell describes a new species, P. insulanus, from Spitzbergen.

Genus Scyphius (*Koch*).

This genus also reminds us of Megamerus by its elongated narrow body. It is very minute, but not quite so much so as the last genus.

Scyphius diversicolor (*Koch*).



Scyphius diversicolor. Copied from figure in Koch's Ubersicht.

Found in damp moss, and under decaying leaves, &c.

Genus Linopodes (*Koch*).

Legs six-jointed; anterior pair excessively long and slender.

One hesitates whether to regard these long-legged mites as the representatives of Phalangium among the spiders, or of the exotic tribe Gonyleptes, which have legs more than a foot in length, and scarcely thicker than a pin. The Linopodes are all extremely minute.

No. 1. Linopodes longipes (*Herm.*, Apt.).—1. Magnified figure of ditto, copied from Hermann's figure.

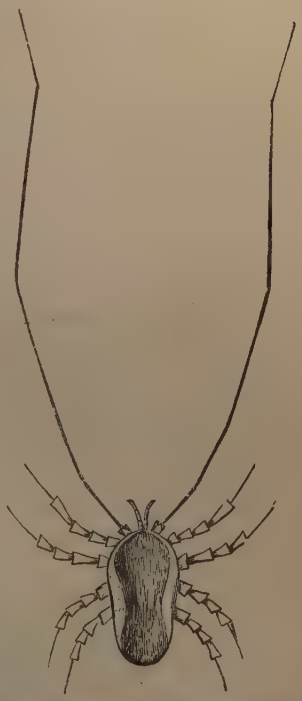
CASE IX. The body is chocolate red, with the under part and sides pale. It is described as living amongst moss.

No. 2. LINOPODES RAVUS (*Koch*, Ubers. Arach.). —**2.** Magnified figure of ditto, copied from Guerin.

No. 3. LINOPODES CURSORIUS (*Walck.*, Apt.).— **3.** Magnified figure of ditto, copied from Walckenaer.

The elongated and thickly haired palpi of this species would seem to call for its separation from the two preceding.

All the above are bright in colour, but more inclining to orange than to scarlet.



Linopodes longipes. Copied from Hermann's figure.

Genus PENTHALODES (*Murr.*, n.g.).

A new genus made to receive the following species.

PENTHALODES OVALIS (Megamerus ovalis, *Dugés*, Ann. Sc. Nat. 1834).

This species having only six joints to the legs, falls into the section of Eupodidæ, instead of the Trombidiidæ, where Dugés placed it (in Megamerus); but it has no line of separation between the thorax and abdomen, and cannot therefore go into Penthaleus (where Koch put it), or any of the other genera having that for a character. The only other place for it is the section with six legs, and no throracic line of separation; but the only genus yet known of these is Linopodes, with which it obviously has no relation, all its legs being moderate in their proportions. A new genus, therefore, is required for it, which we have named Penthalodes.

Penthalodes ovalis. Copied from Dugés.

CASE IX.

Genus STIGMÆUS (*Koch*).

No eyes.

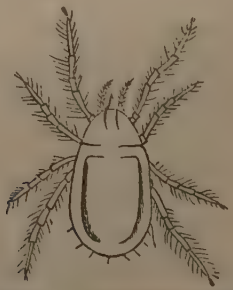
STIGMÆUS CRUENTUS (*Koch*, Ubers.)

Stigmæus cruentus. Copied from Koch. A mere pin's point in size.

Genus CALIGONUS (*Koch*).

Figured but not characterized by Koch.

CALIGONUS PIGER (*Koch*, Ubers.).



Caligonus piger. Copied from Koch. Almost invisible.

2ND SUBSECTION. Legs with seven joints.

Genus RHYNCHOLOPHUS (*Dugés*).

This genus has its feet swollen or not diminished at their termination, the hind legs very long, and the body square or diamond shaped.

M. Van Der Hoeven unites the genus with Erythræus; but it is rather with Smaridia and Trombidium that its affinities lie, some species of these genera having the tarsi swollen like Rhyncolophus.

CASE IX. No. 4. RHYNCHOLOPHUS CINEREUS (*Dugés*, Ann. Sc. Nat., 2d Ser., 1834).—4. Enlarged sketch of ditto.

Rhyncholophus cinereus. Copied from Dugés' figure.

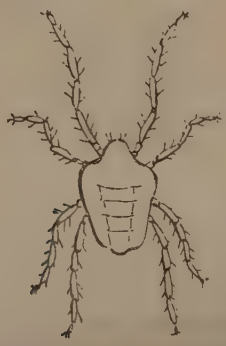
Common in the neighbourhood of Montpellier. It is purplish or brown madder in colour, with a pale stripe down the back.

No. 5. RHYNCHOLOPHUS PHALANGIOIDES (Trombidium phalangioides *Herm.*, Apt.). —5. Magnified figure of ditto.

Rhyncholophus phalangioides. Copied from Hermann's figure.

CASE IX. This is perhaps the Acarus phalangioides of Degeer, which occurs under the bark of trees in the forest of Ardennes. It is black, with a scarlet stripe down the back, and scarlet legs and eye spots.

No. 6. RHYNCHOLOPHUS MAJOR (*Dug.*, Ann. Sc. Nat. 1834).—6. Magnified figure of ditto.



Rhyncholophus major. Copied from Dugés' figure.

M. Dugés places this among the Tetranychi. It seems to us more allied to this form, and perhaps a sex of one of the long-legged species. Black, with red on the back.

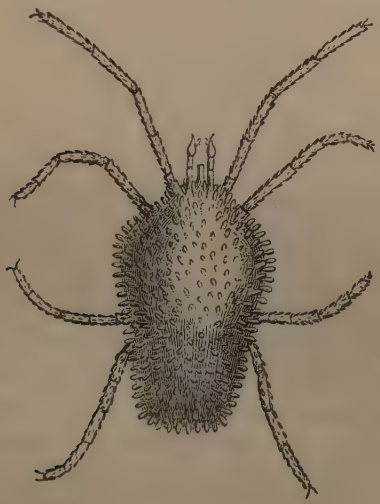
Genus SMARIDIA (*Dugés*).

M. Dugés establishes this genus chiefly on the extensibility of the beak, in the single species on which he found this character. As this, however, requires pressure to be observed, and as without subjecting all the other species to the same test, to see how it affects them, it can scarcely be assumed to be peculiar to it, we do not think it is a character that can be trusted to alone. There is another minor character that is present in Dugés' species that might do to establish a section upon, namely, that instead of hairs the body is covered with papillæ. In Pachygnathus velatus he describes the

Smaridia papillosa. Rostrum. Copied from Dugés.

CASE IX. hairs or papillæ on the body as flattened like blades of grass; but these deviations are mere questions of degree, for various species of Trombidium have the hairs on their body thickened at the end.

No 7. SMARIDIA PAPILLOSA (*Dug.*, Ann. Sc. Nat. 1834).—7. Magnified sketch of ditto.



Smaridia papillosa.

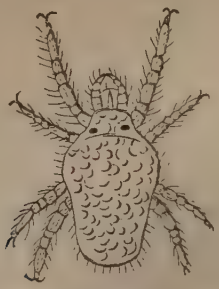
Nearly half a line in length. Brick-red, with a longitudinal dorsal line somewhat paler. Found in numbers on the sandy banks of the streams near Marseilles.

A species from Chili, with the characteristic papillæ, but with the swollen tarsal joint of Rhyncholophus, is figured by Gay in his Historia Physica of Chili.

Genus PACHYGNATHUS (*Dugés*).

This is another genus founded by Dugés on a single species. It has short palpi, and the mandibles chelate, that is, furnished with nippers.

CASE IX. No. 8. PACHYGNATHUS VELATUS (*Dug.*, Ann. Sc. Nat. 1834).—8. Magnified sketch of ditto.



Pachygnathus velatus. Copied from Dugés' figure.

Brick-red, body like that of Smaridia. Found by Dugés in considerable numbers under moist stones.

Genus TROMBIDIUM (*Fab.*).

The chief distinguishing characters of this genus is that the body is divided into two parts; one small, anterior and inferior, bearing the eyes, the mouth, and the two first pair of legs; the other much larger, swollen and velvety, and bearing the two last pair of legs. The two anterior and two posterior pairs are thus at some distance from each other, as shown in the woodcut of the under side of Trombidium holosericeum.

The legs are seven-jointed, and, like all the other mites whose development has been traced from the egg, the early stage of the life of the harvest mites is passed in a form not unlike the mature insect, with the exception that the posterior pair of legs is wanting. These six-footed mites were by the earlier observers supposed to be species of different genera of a division of the Acaridæ, which they designated Microphthiridæ, possessing only six feet, and the different types received different generic names. Three of these belong to the present group, viz.:—Leptus, Ocypetus, and Atoma. Achlysia belonged to the Hydrachnidæ, and Caris was the larva of Argas.

CASE IX. No. 9. TROMBIDIUM PARASITICUM (Atoma parasiticum, *Latr.*).—**9.** Magnified sketch of under-side of ditto, copied from Riley's Seventh Missouri Report.

Atoma parasiticum.

Latreille, in establishing a genus for this mite, proposed the name Atoma for it, by which we suppose he meant an atom; but he subsequently (in 1806) altered it to Astoma. It may be more euphonious, but is not so correct, Astoma meaning without a mouth, which is certainly not the case with this creature. The alteration has not been universally adopted (Dugés, for example, still calls it Atoma in 1834), and seeing that the rigid rules of priority admit (for there seems no good reason under it why the author of a name should have the right to change it subsequently any more than any one else), we shall stick to the first name for the reason above given.

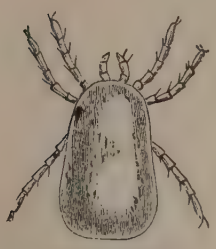
The creature to which the name was given is a minute blood-red mite, parasitic on the house-fly. In this country they do not seem so prevalent, but Mr. Riley mentions that in North America in some seasons scarcely a fly can be caught that is not infested with a number of them clinging tenaciously round the base of the wings.

It is only six-footed, consequently we may be certain that it is the larva of some other species, probably of Trombidium, although what species has not yet been ascertained.

Nos. 10, 11, 12, 13. TROMBIDIUM HOLOSERICEUM (*Fab.*), (T. phalangii, *Dugés's* Ann. Sc. Nat. 1834).—**10.** Magnified figure of young; **11.** Magnified figure of perfect insect, agreeing with Dugés's figure, and No. 13; **12.** Specimen of perfect insect in microscopic slide; **13.** Magnified figure of perfect insect as figured erroneously by Walckenaer and others.

This also is a species that in its young stage is parasitic on another insect. It is then found adhering to the long-legged harvest spider, Phalangium opilio, and there is no doubt as to its transformations, Dugés having carefully observed them. He

CASE IX. collected in the month of June some of the long-legged spiders named Phalangium, which had specimens of this mite adhering to them. They especially torment the females, and place themselves upon them generally behind the posterior haunches, where the palpi of the female (which are much shorter than those of the male), cannot reach them. When they settle on the male he frequently gets rid of them by the help of his longer palpi. The mite at this stage is of a fine orange scarlet, and scarcely equals a grain of mustard seed when at its greatest development, and has an oval, swollen, shining body, which may be compared to that of a full fed tick (Ixodes), but without any shield on the back behind the head. It has six legs, which seem placed more and more to the front the bigger the animal is. It preserves the use of them, however, as long as it lives as a parasite, and can change its place on its victim even with some agility. It has nothing resembling the anterior portion of the body of the full-grown Trombidium. If detached from its victim, when ready to un-



Trombidium holosericeum, young.

Trombidium holosericeum, perfect insect.

Ditto, under-side of ditto.

CASE IX. dergo its transformation, it hides in the interstices of the soil, becomes a yellowish red nymph, like an egg, and rests immovable for about twenty days. During that time Dugés was able to see, through the semi-transparent skin, the gradual formation or development of the eight legs, the additional pair being the last. When perfect it emerges a bright scarlet Trom-

Trombidium holosericeum, hairs on upper side.

Trombidium fuligmosum, hairs on sides.

bidium. In these insects the hairs with which the body is clothed are peculiar. Those on the back have beads like pins, and are barbed with numerous spinules; those on the under side are also spinulose, but are sharp-pointed, as shown in the woodcut.

We have been much puzzled to know whether the Trombidium phalangii of Dugés is really distinct from the Trombidium holosericeum of authors or not, and the impression that remains on our mind is that they are one and the same. There are three styles of figure of a Trombidium given by different authors, which must be either this or closely allied to it. There are two extreme ones—the one figured by Dugés with slight and slender legs. This is what we find in this country, and it is figured above, and it is what is usually known as holosericeum here. Then there is the figure of T. holosericeum given by Walckenaer (Apteres), in Griffith's Cuvier's Animal Kingdom, and in Guerin Meneville's Icones, and no doubt other works that may have copied from them, as being reliable authorities. This figure differs from Dugés's in having the legs thick, and them as well as the body very hairy. In one or more of these works there is also given a copy of Dugés's T. phalangii as another species. Lastly, there is the figure of T. holosericeum in Hermann's Memoire Apterologique,

CASE IX. which, though we mention last, was first in order of date. This is intermediate between the two others, the legs are not so slight as in Dugés's figure and our species, nor so heavy as in the other works. It is near enough to pass for either, but seems to us at least as like Dugés's as Walckenaer's. Now it is to be observed that Hermann, whose original researches after this class of animals were very careful and extended, does not figure the satiny harvest mite in more than one of the above forms. His figure implies that there was only one that he knew. Dugés also knew only one form; but being unable absolutely to reconcile the form he knew with Hermann's figure and description, he, to remove any doubt as to the identity of what he was describing, names it his "Phalangii." His remarks may be of use in clearing up this obscurity. He says, "Several of the species referred to this genus greatly resemble each other, although differing much in size. We know a gigantic species from the East Indies" (West Africa is its true locality), "the Tr. tinctorium. With us the satiny Trombidium (*i.e.* T. holosericeum) reaches a line and half in length. It appears to be rare in the south, at least I have only found it of that large size in our northern departments; but it must be acknowledged that the harvest mite that I have observed in the south, seems in no respect to differ from it but in size, although indeed I might have also been able to refer it to the Tr. triangulare (clerical error for trigonum) of Hermann, which may perhaps not be distinct from the holosericeum. These are uncertainties which the brief descriptions of Hermann cannot dissipate." These two authors were both original observers, and their works referred to are original productions. Those that follow (or at all events the works they wrote) were more literary compilations than original observations, and it has appeared to us possible that, instead of taking their figures anew from authentic specimens, they have merely copied the figures of the authorities who had already treated of the subject. Finding a difference between Hermann's holosericeum and Dugés's Phalangii, they have

CASE IX. supposed them to be distinct species, and copied them, perhaps unconsciously exaggerating the differences. Our belief is that there is only one species, and that Dugés's figure is the correct representation of it, although it is possible that a slight difference in the degree of silkiness of the legs may occasionally occur, which would give them a thicker appearance. We do not apologise for wasting time over this point. Our explanation may save time to many who might otherwise, like ourselves, have spent weeks in trying to make out two species where there is only one.

We have said that the Trombidii feed not on the juices of plants but of animals. Curtis indeed mentions that in France this species is said to injure the spikes of the corn. But this is explained away by Mr. Walker and others, who say that, although it is often abundant in the corn fields of England, it resorts there, not to feed upon the ears but upon the Aphides that infest them. Mr. Stewart says that it feeds on young caterpillars on their emerging from the egg state.

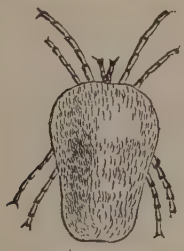
Trombidium trigonum.

No. 14. TROMBIDIUM TRIGONUM (*Herm.*).—14. Magnified figure of ditto, copied from Hermann.

This is so far like holosericeum that Dugés's conjecture, that it is only a variety of it, may possibly be correct. Hermann, however, figures the hairs on its back as different, as shown above; and to assist in its determination we also give a copy of Hermann's figure of the species.

Ditto, hairs on back.

CASE IX. No. 15. TROMBIDIUM CURTIPES (*Herm.*).—**15.** Magnified sketch of ditto, copied from Hermann's figure.



Trombidium curtipes.

Ditto, hairs on back.

Ditto, hairs on sides.

This is very like Tr. holosericeum, but it is only half the size, a little less brilliant, and the legs are perceptibly shorter. Hermann adds that the hairs on the sides are shorter and differently shaped than in holosericeum and allied species. We give figures of these hairs copied from his. This last character, however, was not observed by Dr. Johnston in specimens found in Berwickshire by Mr. Hardy. We have no assurance, however, that Dr. Johnston had the true curtipes under his eye, neither do we yet know the extent of variation in the Trombidii, and it is perhaps premature to say that this is a good species. It may be only a stunted form of holosericeum.

TROMBIDIUM MILIARE (*Walck.*, Aptères.).

There is another Trombidium figured under the above name by Walckenaer, as distinct from holosericeum, although very like it. In form it agrees with it, as figured by us above, but is bespattered with small dark or obscure spots or depressions.

No. 16. TROMBIDIUM FULIGINOSUM (*Herm.*, Mem. Apt.).—**16.** Magnified sketch of ditto, copied from Hermann's figure.

This species diverges more from holosericeum than the last.

CASE IX. It is more elongate, more smoky and dusty in colour; and the hairs on its body are of a finer and more slender type.

No. 17. TROMBIDIUM BICOLOR (*Herm.*, Mem. Apt.).—**17.** Magnified figure of ditto, copied from Hermann's Memoire.

Very like fulginosum in form, but colour of body black with a bluish reflection, and legs scarlet.

Nos. 18, 19. TROMBIDIUM FASCICULATUM.—**18.** Enlarged figure of ditto; **19.** Specimens of ditto (4).

This species, which is a giant among its brethren (being about one-third of an inch in length), is common in the East Indies and East Indian Archipelago. It is bright red when fresh, and deeper in parts, but soon fades, especially if it has been in spirits. It is tufty with velvety reflections.

Trombidium fasciculatum, magnified and natural size (small specimen).

Nos. 20, 21. TROMBIDIUM TINCTORIUM (*Fab.*).—**20.** Enlarged figure of ditto; **21.** Specimens of ditto (o).

From the West Coast of Africa, of the same size and appearance as the East Indian species. Kirby and Spence say (on we know not what authority) that this species, or some allied species, (they call it "a species of mite (Trombidium tinctorium) from Guinea and Surinam") is employed as a dye; and they suggest that it might be worth while to try whether our own T. holosericeum would not also afford a valuable tincture. We are sceptical

Trombidium tinctorium. Nearly as large as the preceding.

CASE IX. about T. tinctorium ever having been used as a dye, still more so of T. holosericeum ever being obtained in such quantities as to be utilized, and quite certain, from what is to be seen of the insect when preserved in cabinets, that if it were, the colour of none of them would stand, unless some suitable mordant to fix it were also found.

TROMBIDIUM BULBIPES (*Packard*), 3rd Ann. Report on injurious and beneficial Insects of Massachusetts, 1873.

Trombidium bulbipes. Copied from Packard's figure.

Palpi of ditto. Copied from Packard.

Dr. Packard (loc. cit.) describes this as an unexpected enemy of the Aphis, which he found in July and August in considerable numbers in his garden in Massachusetts, busily engaged in devouring the plant lice on the rose bushes. It is scarlet-red, like most of the rest of the Trombidii, and we retain it among them provisionally; and although its palpi without appendage, here figured, may seem to call for a new genus for its reception, its swollen tarsal joint and elongated anterior legs seem to indicate an affinity with Rhyncholophus.

No. 22.

Trombidium gryllarium.—Larva.

TROMBIDIUM GRYLLARIUM (Astoma Gryllaria, *Le Baron*, Illin. Ent. Rept., 156).—**22.** Enlarged figure of larva.

As in other insects the same class at once furnishes us with friends and enemies, so the mites are not entirely to be regarded by man from a hostile point of view. If they carry on warfare on their own account it is not always against our interests. It is sometimes as our allies and against

CASE IX. a common enemy. It is so with this species. Mr. Harris, in his treatise on some of the insects of New England, injurious to vegetation (1852), drew attention to the fact that the locusts of the eastern coasts of America were much infested by little red mites, "belonging apparently to the genus Ocypete" (which is a synonym for Atoma), and that these so much weakened the insects by sucking the juices from their bodies as to hasten their death. Ten or a dozen of them would frequently be found pertinaciously adhering to the body of a locust beneath its wing covers and wings. The dread of the locust has now passed from New England. It is in the western prairies that it now reigns, where immense swarms of locusts descend from the Rocky Mountains where they breed, and spread desolation and famine over thousands of square miles. But the little red mite that helped to reduce their numbers in the East, or an equivalent species, is there at its post in the West, employed on the same duty; and the value of its services has been recognised and acknowledged by numerous observers. In 1872 and 1875, respectively, it was described by Mr. Le Baron, State Entomologist of Illinois, and Mr. Riley, State Entomologist of Missouri. In their opinion it is as formidable an enemy to the Rocky Mountains locusts as it was in former years to that of the East. These locusts are often more or less covered with them, especially round the base of the wings. We reproduce Mr. Riley's figure of one of the mites. They are small red creatures, no bigger than the head of a pin, soft and extensible, and they swell like a tick, so that their six legs, though easily visible when the animal first attaches itself, become more or less invisible as it swells; although on careful examination they will always be found. The mite when so attached presents itself as a bright red, swollen, ovoid body, immovably attached to its supporter. So far as is yet known it has not been traced beyond the six-legged larva stage, but it will certainly be found to be developed into an eight-legged scarlet mite. Very probably the next species, which is found in the same localities, and whose mission is also to keep

CASE IX.

down the numbers of the locusts, may be its further stage, and it would be curious if it were so; then it would be the young mite attacking the old locusts, and the old mite attacking them in their youngest stage: viz., in the egg. Seeing how little mischief the larvæ of Tr. holosericeum seem to do to the Phalangium, on which they fix themselves, it was scarcely to be expected at first sight that they would have any great effect in diminishing the number of the locusts; but it appears to be otherwise. Mr. Riley quotes various informants who speak to their destroying them in perceptible numbers; and one paper, *The Prairie Farmer*, which has acquired renown for its accurate entomological news, says (August 21, 1869), "the course of the locusts was brought to a sudden halt here by the operation of some parasites, appearing in the shape of small red mites, which attach themselves to the body under the wings, where they suck the carcass to a dry shell; the dead bodies of the grasshoppers almost covering some plants, where they have taken hold of a leaf or a stalk, and clasped it with a dead embrace; many others fall to the ground, too weak to rise again. In a half-day's examination, where they were very thick, we failed to find more than two grasshoppers not so attacked, and this was not local, for a distance of thirty miles across the country they were found similarly affected."

Trombidium sericeum.

No. 23. TROMBIDIUM SERICEUM (*Say*).—**23.** Magnified sketch of ditto, copied from Mr. Riley's Seventh Missouri Report.

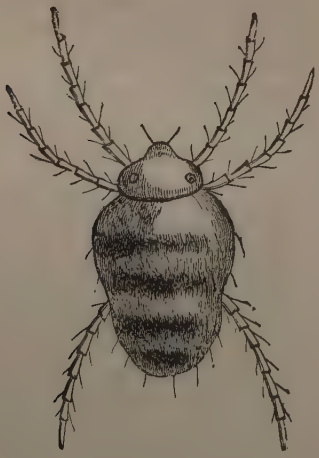
Only two species of North American Trombidium having been hitherto described by Say, and these only in brief terms, it is very possible that this is a new species; but Mr. Riley has wisely declined (although not without hesitation) to run the risk of adding to the synonymy—and as he has given a good figure of it, this will in future be the type of Say's imperfectly

CASE IX. described sericeum: we reproduce his figure, and have only to add that the colour is pale red. It was found in Iowa and Minnesota in great numbers, creeping into the holes in which the locusts' eggs have been deposited, and eating the contents of the eggs voraciously.

No. 24. TROMBIDIUM MINIATUM (*Herm.* Mem. Apt.).—**24.** Enlarged figure of ditto, copied from Hermann.

Very similar in form to the species already described as Megamerus celer, but of a pale red lead colour.

No. 25. TROMBIDIUM AURANTIACUM (*Walck.* Apt.), (Tr. Aphidis, ? *De Geer*).—**25.** Enlarged figure of larva, copied from Walckenaer's Apteres.



Trombidium aurantiacum.

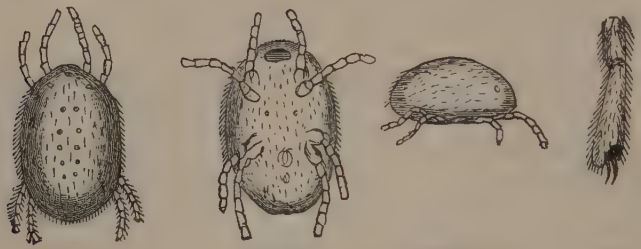
A squat obtuse orange-coloured mite, of which the perfect form is not known with certainty, but it has been supposed to be a species described by De Geer, under the name Trombidium aphidis, which feeds on the black Aphis, which is so abundant in beans, poppies, and other plants.

CASE IX.

Genus CALYPTOSTOMA.

CALYPTOSTOMA HARDYI (Cambridge Ann. Nat. Hist. 1875).

As these pages are passing through the press, a new genus and species has been described by Mr. Cambridge, differing in a



Upper side. Under side. Side view. Leg.

Calyptostoma Hardyi. Copied from Mr. Cambridge's figure.

remarkable manner from any known type of Trombidium, and running counter to all the characters hitherto used to define that family, but still unquestionably belonging to it. It will be seen that the mouth in this species is a mere hole on the anterior part of the underside of a bladder-shaped body, and the parts in it seem, in Mr. Cambridge's figure, too indistinct to be depended upon. It has all the aspect of a larva with eight legs, the larvæ of Trombidium having little or no appearance of a head or mouth. If it had been a six-footed insect with the form of a mature species, that might have been explained away by supposing that all the changes of skin were not over, and that, as sometimes happens, the mature form was anticipating the final change and complete perfection of form; but here the signs of maturity that last appear are present, while the form of the body still remains that of a larva. It was found by our old friend Mr. Hardy in the Cheviot Hills.

Genus ERYTHRÆUS.

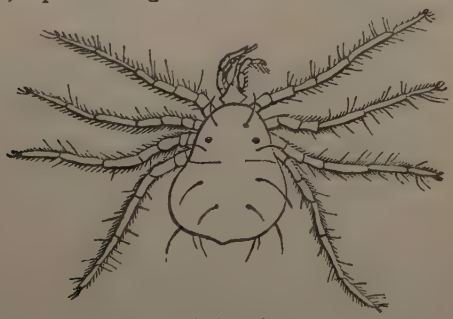
This genus is distinguished from Trombidium, by having no division of the body, and by the last joint of the legs being very long and slender. It is glabrous, semi-transparent, and has a pink or carmine shade of colour.

CASE IX. No. 26. ERYTHRÆUS RURICOLA (*Dug.* Ann. Sc. Nat. 1834).—**26.** Enlarged sketch of ditto copied from Dugés's.

Erythræus ruricola.

This species is of a beautiful carmine colour, but it is so small that it could scarcely be observed by the naked eye were it not for their whirling course, like a particle of dust blown about by the wind. They chase smaller acari than themselves, and carry them off in their palpi, not sparing, probably, even the smaller individuals of their own species. They are found near Montpellier.

No. 27. ERYTHRÆUS CORNIGERA (Actineda cornigera, *Koch.*).—**27.** Magnified sketch of ditto, copied from figure in Koch's Ubersicht.



Actineda cornigera

Koch's genus Actineda seems to us not to differ generically from Erythræus. Some species are broadest behind, others in front, and in Erythræus both are equal.

CASE X.

Family BDELLIDÆ (Snouted Mites).

The habits and livery of this long-nosed group are entirely that of the Trombidii, and there is little doubt that their affinity is much greater with it than with any other tribe. Still it differs so much in the parts of the mouth and palpi, that there can be no objection to following the general opinion, and regarding it as a distinct section. Many of them (indeed, all in the section as originally constituted, Scirus of Hermann) appear to have a head; but it is only the mouth that usurps this appearance; the real head is still merged with the thorax, as is obvious from the fact that it still carries the eyes. There are some species that have all the above characters except the constriction into a neck behind the mandibles; and we think that there are indications that this absence of a neck has been used by Dujardin for a genus Molgus proposed by him for a species found on the coasts of France, and said by Gervais (Apteres, iii. 253) to have been described by him in a paper laid before the Institute in 1842, but which would appear never to have been published, for there is no appearance of it either in its "Memoires," or "Memoires présentées." M. Gosse thinks that it must have been a marine species, but the term coasts on which he founds seems to us rather to refer to the shores.

A more essential character of the family even than the quasi head or snout, lies in the long projecting narrow mandibles, and in the extension and abrupt bending of the palpi, so as to look like antennæ. The mouth consists of a rostrum, composed of a central conical tube, supported on each side by a valve, which together form a sheath.

The species known are not numerous, but several genera have been proposed for them, chiefly founded upon the presence or absence of eyes, their number and their position. There is one species with no eyes, one with two, which makes the genus Cunaxa of Heyden: another with three (the genus Cyta of Heyden), another with four (Bdella), and another with six. The mere

CASE X. statement of such diversity, accompanied with no corresponding differences of other structure, would seem to show that in this group the presence, absence, or number of eyes was not a matter of generic importance; and as we go along we shall see other instances of the same thing in other families of mites and insects.

There are many species of insects found in the deep and obscure recesses of limestone caverns, or other dark places, which have no eyes. The spot where the eyes should be is smooth, and to the naked eye identical with the neighbouring surface, but some of them beyond doubt belong to well-known and unmistakeable genera which have eyes. These organs would appear, therefore, not to be entitled to rank among the structural organs which distinguish important divisions of living beings.

Genus MOLGUS? (*Dujard.*).

Mouth or quasi-head without a constriction or neck behind it.

No. 1. MOLGUS LONGICORNIS (*Linn.*), (Ac. Basteri, *Johnston*), Acarides of Berwickshire, in History of Berwick, Nat. Club, ii. 227.).—**1.** Magnified sketch of ditto.

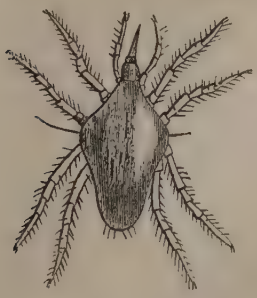
Mouth of Molgus longicornis. Copied from Dr. Johnston's figure.

As already said this probably belongs to Dujardin's genus Molgus. It occurs in Berwickshire, in Northumberland, and other parts of England, where it is common on the sea-shore during the summer months, running quickly about among stones above high-water mark.

It is scarlet, with the body blood red, and as if divided into several large subquadrangular compartments, formed apparently by a thickening of the skin, pear-shaped, about an eighth of an inch in length: in fact very like the small weevil called Apion in shape and size.

CASE X.

There are two species that bear the name of longicornis: the present, and one a Bdella longicornis—which were confounded by Linnæus, this being the species so called in his Fauna Suecica; the other, that in the Systema, which is easily distinguished from this by its palpi, terminating in two long bristles, viz., like the palpi in Scirus vulgaris. See next species.



Eupalus vitellinus. Copied from Koch's Uberscht.

Genus EUPALUS (*Koch*).

EUPALUS VITELLINUS (*Koch*. Ubers).

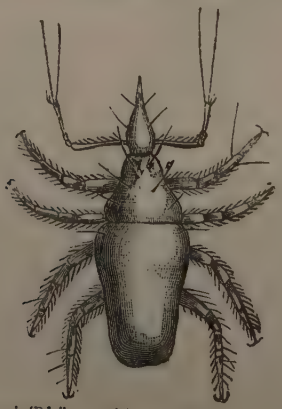
This seems to come near Molgus, if not actually to belong to it.

Genus SCIRUS (*Hermann*).

Apparently with a head and neck.

The name Scirus, although only second in date, must be adopted for this genus, because the original typical name, Bdella, has been diverted from its more general application to those species having four eyes.

SCIRUS VULGARIS (*Herm.*) (Bdella egregia, *Koch*, Ubers.).



Scirus vulgaris (Bdella egregia). Copied from Koch's Ubersicht.

CASE X. The characteristic break in the palpi, of which we have just spoken, is well shown in this species. It is scarlet, and found among mosses.

No. 2. SCIRUS INSECTORUM (*Herm.* Mem. Apt.), (Leptus Phalangii, *Curtis*, in Farm Insects).—**2.** Magnified sketch of larva of ditto.

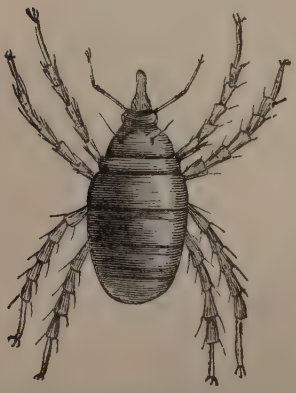
Scirus insectorum. Copied from Hermann's figure.

Scirus insectorum (Leptus Phalangii, Curtis). Copied from his figure.

This insect is described by Curtis, in his "Farm Insects," as one of the correctives of the wire-worm beetle. He found it on Elater ruficaudis, and it attaches itself to various other insects. Hermann says he found it on Elater, Tipula, and spiders. This habit has led to its being confounded with the larva of Trombidium holosericeum, which attaches itself, as already said, to the harvest spiders (Phalangium opilio). De Geer took it for the Acarus phalangii, and Curtis followed him, but seeing that it was only six-footed, rightly put it in the old genus, Leptus, proposed for the six-footed Acari, before it was known that they were only the young of other species. The true genus to which this belongs, however, is easily gathered from the snouted mouth and extended palpi: and Curtis's figure, which we give here, is unmistakably only an individual of the Scirus insectorum figured by Hermann, not so well filled up as his specimen. It occurs both in this country and on the Continent.

CASE X. No. 3. SCIRUS HEXOPHTHALMUS (*Gerv.*, Ann. Sc. Nat. 1841).—**3.** Magnified sketch of ditto, copied from Gervais.

This is the species with six eyes, for which another genus would have to be established if every change in the number of eyes is to call for one. It is reddish orange coloured.



Scirus hexophthalmus. About the size of a pin's head.

Scirus obisium.

No. 4. SCIRUS OBISIUM (*Gerv.*, Ann. Sc. Nat. 1841).—**4.** Magnified sketch of ditto, copied from Gervais.

This has no eyes, and would behove to have a genus for itself too, if they are important as characters. As already said, they do not appear to be so.

No. 5. SCIRUS VESTITUS (Bdella vestita, *Koch*).—**5.** Magnified sketch of ditto, copied from figure in Cuvier's Regn. Anim., French illustrated edition (without date), Arachnids, edited by Dugés and M. Edwards.

A species with red and black marks disposed in patches.

CASE X.

Family HYDRACHNIDÆ (Fresh Water Mites).

These, as already said, are merely Trombidii modified to suit the different element in which they live, and with other variations that might be expected from such a modification. They have the same predominance of bright colour, scarlet and various shades of red preponderating some of them have the same finger and thumb termination of the palpi, although others have it either entirely absent, or nearly so; but almost all have the last joint hooked so as to serve as an anchor or a grappling hook. Divers of them in one stage or other fasten themselves upon other insects, like the larvæ of the harvest mite. They are probably all carnivorous, perhaps living on minute Infusoria; but this we believe is not known with certainty. In all, the tarsi have two claws, with a very short shank, or almost none at all.

Palpus of Hydrachna.

Claw of Atax Bonzi, seen from front and side, retracted and expanded. Copied from Claparede.

Their transformations are very remarkable, but for them and the anatomical details of their structure, we must refer the reader to M. Dugés's Memoirs in the "Annales des Sciences Naturelles, Zoologie" 1834. We have no space for these, and can only briefly glance at a few of them as we go along. The whole group being very homogeneous, there is not much room for the creation of genera, but the remarkable difference in the transformations has in many instances supplied this. The following are the more remarkable:—

CASE X.

1st Section.—Bog or Mud mites.

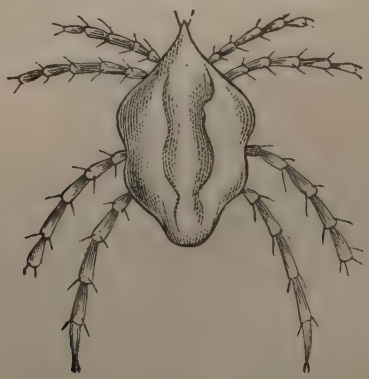
Feet adapted for walking, not swimming.

This group is the link between the swimming water mites and the harvest mites. Like Trombidium holosericeum, they are soft and velvety, and mostly of a scarlet red colour.

Genus Limnochares (*Latr.*).

No. 6. Limnochares aquaticus (*Linn.*) (*L. holosericeus, Latr.*). — 8. Magnified sketch of ditto.

This species is vivid scarlet. Its young is also very like that of Trombidium holosericeum, has only six feet, and adheres to Gerris lacustris, a water bug, and other water insects, generally near the head, and although a water insect, has no ciliæ to its



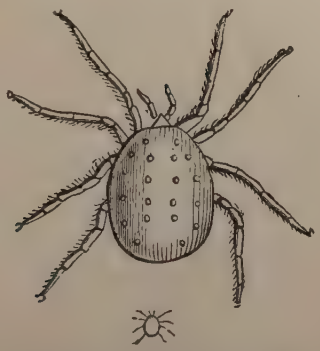
Limnochares holosericeus. About 1¼ lines in length.

legs or swimming powers, but creeps slowly over the mud and plants under water. The body is irregularly oval, cone-shaped in front, but from its softness is susceptible of accidental or spontaneous deformation, so that it varies in appearance and form.

Genus Thyas (*Koch*).

More nearly resembling a Hydrachna, but feet adapted for walking.

CASE X. THYAS VENUSTA (*Koch*).



Thyas venusta. Copied from Koch's Ubers.

Our knowledge of this genus and the succeeding two genera, as well as various others of Koch's genera noticed in this work, is confined to what we gather from his Ubersicht; and its meagreness is not to be ascribed to us, but to the source whence we have drawn it.

Genus SMARIS.

Distinguished by the absence of palpi. Its skin is clothed with papillæ like Smaridia, and some of the Trombidii.

SMARIS EXPALPIS (*Koch*).

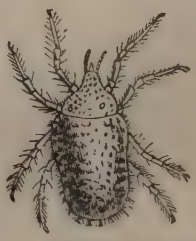
Smaris impressa. Copied from Koch's Ubersicht.

CASE X.

Genus ALYCUS.

Clothed, like the preceding, with papillæ, and otherwise formed like a Trombidium.

ALYCUS ROSEUS (*Koch*).



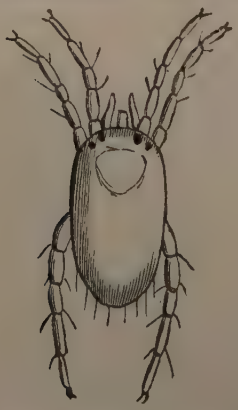
Alycus roseus. Copied from Koch's Ubers.

2nd Section.—POND WATER MITES.

Feet adapted for swimming. Four eyes.

Genus EYLAIS (*Latr.*).

Nos. 7, 8. EYLAIS EXTENDENS (*Latr.*).—**7.** Magnified sketch of larva; **8.** Ditto of perfect insect.



Eylais extendens, young form. Copied from Dugés.

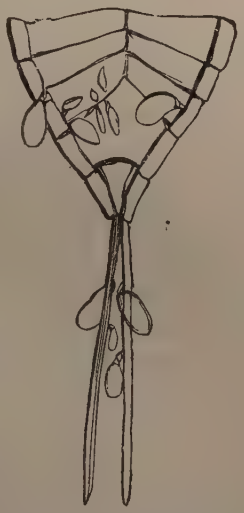
Ditto perfect insect.
Size of a mustard seed.

Of this genus only one species has been described. Its main characters are, that the palpi have the basal joints short, the penul-

CASE X. timate large, and the last armed with spines. The feet are long and slender and ciliated, except the two last, which are only pilose. Its colour is pale red, and its size about that of a mustard seed.

Genus HYDRACHNA.

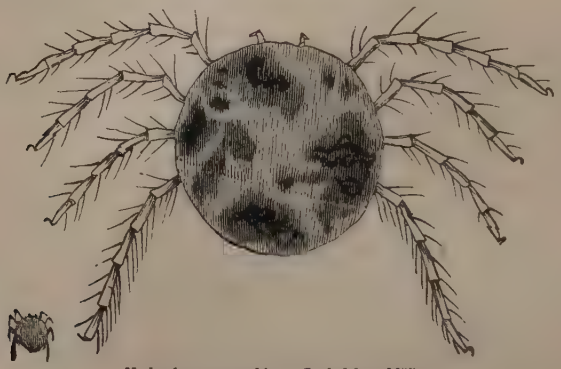
The genus is restricted by Dugés to those fresh water mites that have palpi with the third joint largest, a beak of the same length as the palpi, and mandibles with sharp blades. Their transformations have been fully observed, and are very interesting. From the eggs which have been laid in spring in the stems of water plants, perforated for the purpose, little hexapod animals come to view, with a large heart-shaped sucker in front, which might be taken for a head, but that the eyes are situate behind it on the anterior margin of the back. Subsequently they attach themselves to different water insects (Nepa, Ranatra, Dytiscus, &c.); and whilst the abdomen is growing and extending itself into an elongated sac, the feet and the sucker remain of the same size. After a time, however, the feet drop off, and the creature remains like a bag hanging from the insect to which it is affixed. For long these bags were thought to be the eggs of the Nepa, and it was described as being like the frog of Surinam, that laid its eggs on its own back, and hatched them out of its skin. This stage corresponds apparently to that of the pupa in other insects, the perfect insect being formed within the skin, like a fly in its pupa. The wood cuts show its various stages in the species. Hydrachna globulus, now Hydrochoreutes globulus, a little further on.



Enlarged sketch of hinder part of abdomen of Nepa cinerea, with nymphs of Hydrachna adhering to it.

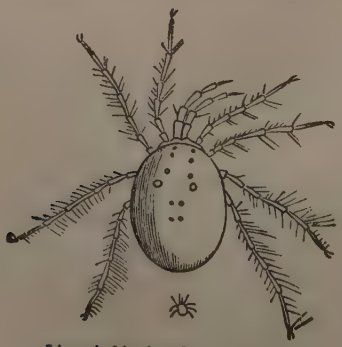
CASE X. No. 9. HYDRACHNA GEOGRAPHICA (*Koch*).—9. Magnified sketch of ditto, copied from figure in Koch's Arachnidæ.

This is a very handsome species, with something like a geographical distribution of patches of scarlet and black.



Hydrachna geographica. Copied from Müller.

Koch breaks up this group into three additional genera, chiefly founded upon the dimensions and proportions of the palpi. They do not appear to deserve separation from Hydrachna. They are—LIMNESIA, HYDRYPHANTES, and HYDRODROMA.



Limnesia fulgeda. Copied from Koch.

3rd Section.—RIVER WATER MITES.

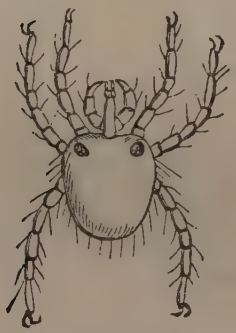
Legs fitted for swimming. Two eyes.

CASE.

Genus DIPLODONTUS (*Dugés*).

Nos. 10, 11. DIPLODONTUS SCAPULARIS (*Dug.*, Ann. Sc. Nat. 1834).—**10.** Magnified figure of larva; **11.** Ditto of perfect insect.

This genus has the mandibles chelate, or quasi chelate, that is, provided with a nipper or its equivalent. Other characters are drawn from the different relative proportions of the joints of the legs. The legs are ciliated, but the ciliae are so fine, and their



Diplodontus scapularis, larva.

Ditto, perfect insect. About the size of a sweet pea.

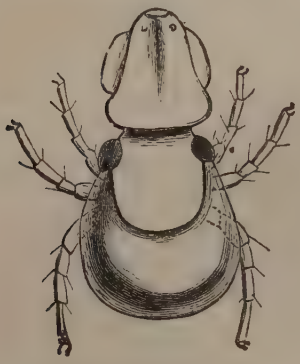
motion so rapid, that although tolerably long, the naked eye cannot see them when in motion, and the animal at the first glance seems to move by some interior hidden mechanism. There are several species of this genus. The colour of the present species is red behind, interrupted in the middle, and black in front, with some specks of red scattered through it. Dugés places this species in the genus Diplodontus. Koch removes it into his genus Hygrobates. We have preferred to follow Dugés.

Genus HYDROCHOREUTES (*Koch*).

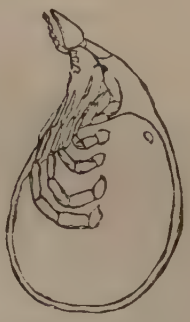
Nos. 12—16. HYDROCHOREUTES GLOBULUS (Hydrachna globulus, *Mull.*).—**12.** Magnified sketch of first stage of larva; **13.** Specimens of Belostoma grandis, *Linn.* (the large water scorpion), with nymphs of Hydrachnidæ adhering to various parts of its body; **14.** Enlarged sketch of hinder part of British water scorpion (Nepa cinerea), with nymphs of Hydrochoreutes globulus adhering to its body; **15.** Sketch of nymph of ditto still more

CASE X.

highly magnified ; **16.** Magnified sketch of Hydrochoreutes globulus, perfect insect.



Hydrochoreutes globulus, larva.



Ditto, nymph, under side.

Ditto, perfect insect, under side. About the size of a No. 5 lead drop.

For an explanation of the above figures, see p. 151.

This species is pale red in the larval stage, dirty white in the nymph, and rich maroon or purple in the perfect stage.

Genus Atax (*Fab.*).

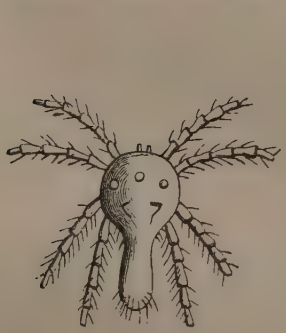
In the genus Atax the palpi are subulate, with the last joint falcate or inguiculate. In the males of some species the body is truncate behind. These M. Dugés supposed to belong to a different genus, which he named Arrenurus, of which Koch describes no less than forty species, many of which, no doubt, must be referred to other genera besides Atax.

CASE X. No. 17. ATAX BONZI (*Claparede*, Studien an Acariden).—**17.** Magnified sketch of newly developed larva, copied from Claparède's figure.

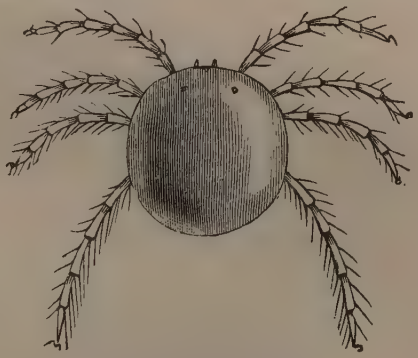
Atax Bonzi, which formed the subject of careful study, and an admirable memoir by M. Claparède, is a parasite, which lives within the shell of the fresh-water mussel. It is semi-transparent and pale yellowish, with some brown.

Nos. 18, 19. ATAX GLOBATOR (*Mull.*).—**18.** Magnified sketch of male; **19.** Ditto of female; both copied from Müller's figures and descriptions.

The male has a prolongation of the body behind like a tail. It is virescent, except this prolongation, which is pellucid. The female is round and pale blue, with virescent legs.



Hydrachna globator, male.



Hydrachna globator, female.

No. 20. HYDRACHNA BUCCINATOR (*Mull.*).—**20.** Magnified sketch of ditto, copied from Muller's figure and description.

Another tailed species. The body is red, black behind, and the tail yellow.

No. 21. ATAX MINIATA (*Koch*).—**21.** Magnified figure of ditto, copied from Koch's Arachnidæ.

Of a rich red-lead colour.

No. 22. ATAX VARIPES (*Koch*).—**2.** Magnified figure of ditto, copied from Koch's Arachnidæ.

Body pink with dark markings behind, legs varied with white and brown.

CASE X. Nos. 23, 24. ATAX HISTRIONICUS (*Herm.* Mem. apt.).—**23.** Magnified sketch of male, Arrenurus viridis, *Dug.* ; **24.** Ditto of female, Atax histrionicus, *Dug.*, copied from figures by Dugés, in Ann. Sc. Nat. 1834.

Atax histrionicus (Arrenurus viridis, *Dug.*), male.

Atax histrionicus, female.

About the size of a mustard seed.

The male is pale yellowish green, the female a rich purple, with four large black blotches.

Besides the foregoing, Koch proposes several other genera for species of this group, viz.:

NESEA, PIONA, HYGROBATES, ATRACTIDES, ACERCUS, and MARICA;

but neither his figures nor his descriptions are sufficiently precise to allow of our judging as to their value, especially in a family where the general resemblance and the sexual differences are both so great.

Genus PONTARACHNA (*Filippi*).

No. 25. PONTARACHNA PUNCTULUM, *Fil.*—**25.** Magnified sketch of ditto, copied from drawing and description of Filippi.

This is a very minute and inconspicuous Hydrachna, with a madder-brown irregular shaped patch covering the back; but it is interesting from its having been found in the sea at Naples, instead of in fresh water. Since then another from the North American Seas has been described by Dr. Packard. Filippi made the separate genus for his species, which we have adopted on his responsibility.

CASE XI.

Family GAMASINÆ.

THE members of this family are either found on the ground in damp places or parasitic on some animal or other; and subject to the usual qualification of occasional exceptions, the palpi are filiform, that is, of nearly uniform thickness throughout; they usually project forwards on each side of the mandibles, and have the terminal articles bent downwards. The mandibles are chelate, that is, provided with minute nippers. There are no eyes. The legs are not ciliated, but adapted for motion on dry land. They have seven joints, and there is a tendency in the second pair of legs in some species to become larger and thicker than the others, often with knobs or excrescences on different parts of them. The tarsi have two claws, which emerge, as it were, from or alongside a kind of frill or bag, which is called a caruncle, and which no doubt fulfils to some extent the office of a sucker. The accompanying figures show some of the different forms this caruncle assumes.

Claw and caruncle of Gamasus tetragonoides.

Claw and caruncle of Dermanyssus avium.

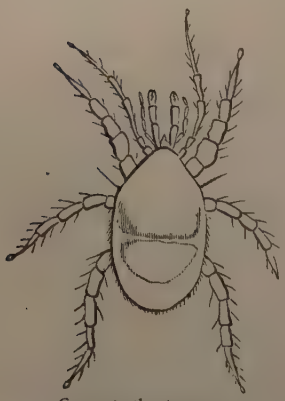
Claw and caruncle of Sejus auris.

In some species the skin is chitonous, like the covering of a beetle, but not so hard; and the colour is usually pale brown or fawn. In certain species the skin is chitonous only in part, the rest being soft, pliant, and colourless; and in others it is entirely soft, and naturally white or yellowish, but showing the colour of

CASE XI. the food it has taken (as for instance, blood) through the walls of the body. With few exceptions they are parasitic, at all events at some period of their life, the majority being so on insects; but there are others that are troublesome to birds and other animals, forming the passage to the next section, the Ticks. They form a very natural and easily recognised group. If we capture a "shard-borne beetle" or a humble bee, we shall, very often, find them infested by a large number of yellowish mites hanging about their legs or adhering to their abdomen. These are almost sure to be Gamasidæ. They are sometimes of large size compared to that of the animals on which they are parasitic. Did the same proportion exist on man, we should have lice as big as our fists or our hats.

Sub-Family GAMASIDÆ.

When not free, parasitic on insects.



Gamasus coleoptratorum. About ¼ line in length.

Genus GAMASUS (*Latr.*).

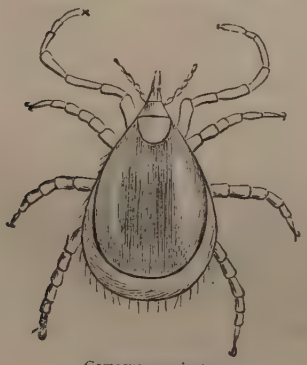
In this genus the body is covered either in whole or in part by a smooth and even chitonous shell. The labrum is trifid. The second pair of legs often thickened; the first pair usually the longest, but also the slenderest.

Nos. 1, 2. GAMASUS COLEOPTRATORUM (*Linn.*).—**1.** Enlarged figure of ditto; **2.** Specimens (2).

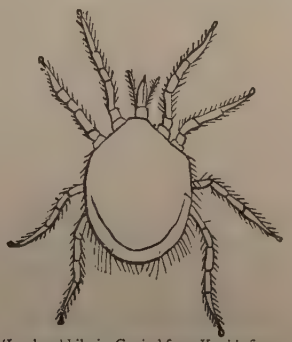
This species has only part of its outer skin hard and chitonous; there is a soft white space between the upper and under surface, and also a similar band across the back. Its colour is fawn. Found on various beetles. In winter it is found under stones. It is a peculiarity of all these parasites on insects, that they soon die after being removed from the insect or

CASE XI. from the stone under which they have taken refuge, unless they are kept moist. The insects on which they live are chiefly subterranean, making burrows in damp soil, or under cow dung, &c.

Nos. 3, 4. GAMASUS MARGINATUS (*Dug.*).—**3.** Enlarged figure of ditto; **4.** Specimens.



Gamasus marginatus. About ⅓ line in length.



Gamasus (Laelaps) hilaris. Copied from Koch's figure. About the size of a pin's head.

Broader, rounder, and darker in colour than the last, and without the transverse soft white space across the back, but with the marginal space wider, especially behind. This species is also found on beetles more frequently even than the last, and sometimes along with them; but, generally speaking, more than one species of mite is not found on the same beetle. Hermann, in his Mémoire Apterologique, reports that this species lives on dead bodies, and cites the curious fact that one was observed by his artist running on the corpus callosum of the brain of a soldier who died in the military hospital at Strasburg, which had been opened but a minute before, and the two hemispheres and the pia mater just separated. Hermann thought not, but we have no doubt that it was merely a case of first come, first served. Prompt as the doctors had been with their examination, the mite had been prompter.

Koch has established a genus which he has named Laelaps, and the only character wherein it differs from Gamasus is in not

CASE XI. having the anterior legs slenderer and longer than the rest; in other respects it corresponds with the section containing Gamasus marginatus; but the elongation of the anterior legs does not seem a generic character, but rather one of degree; indeed Koch's own figure of Laelaps hilaris, of which we give a copy, does not bear out his own diagnosis, the anterior legs in it being both longer and slenderer than the other legs. We have, therefore, not adopted the genus Laelaps.

GAMASUS HILARIS (Laelaps hilaris, *Koch*, Ubers., p. 88, t. x., f. 48).

Koch says that this species and three others belonging to the same genus Laelaps are parasitic on mice, although he never found any on the house mouse. He regards them as specially assigned to mice, and only to be found upon them. This figure, however, looks so like other Gamasi which are found wandering at times, that it may be well to wait for confirmation of Koch's assumption before definitely adopting it.

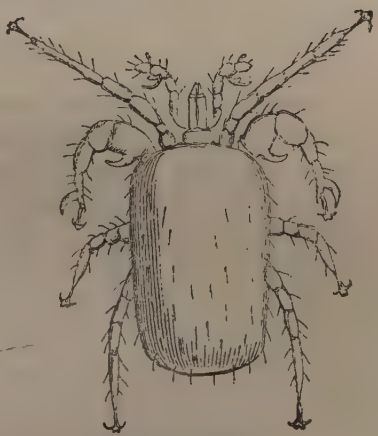
There are several species formed upon the same plan as these, which are difficult to distinguish from each other. Koch describes about a score. One is the G. testudinarius of Hermann. We possess another of comparatively large size and very pubescent, with a fringe of long hairs on each side, especially in front. It was taken from the under side of the neck of Phanæus lancifer, a large South American dung beetle. The portion disclosing the soft skin is in it larger than usual. Dugés mentions a very large species which he, too, found on a Brazilian Copris (C. mimas), and which, from its size, he called Gamasus gigas. He says it was as large as our common Ixodes. If he means the male Ixodes, it may be the species of which we have been speaking, which then would sufficiently correspond with his description. If a replete female Ixodes, then it must be something different. We have several other species taken from beetles from different countries differing but slightly in size, but probably distinct.

CASE XI. Nos. 5, 6. GAMASUS QUADRIPUNCTATUS (n. s.).—**5.** Enlarged figure of mite; **6.** Specimen (1).

This species is more than a half larger than our common species. It is more elongated, shows less of the white margin at its apex—none being visible at the sides—and it has, shining through the brown hard skin of the back, four black round spots. It is from Old Calabar.

No. 7. GAMASUS CRASSIPES (*Herm.*).—**7.** Enlarged figure of ditto.

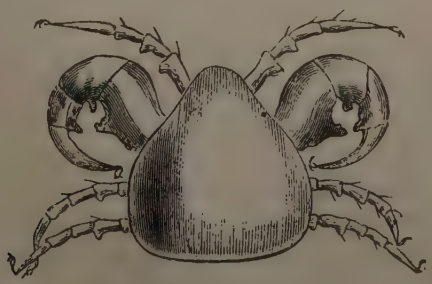
Gamasus crassipes. About ½ a line in length. Copied from Hermann's figure.



Gamasus tetragonoides. Copied from Dugés' figure.

No. 8. GAMASUS TETRAGONOIDES (*Dug.*).—**8.** Enlarged figure of ditto.

Nos. 9, 10. GAMASUS PODAGER (*Murr.* n. s.).—**9.** Enlarged figure of ditto; **10.** Specimen (1).



Gamasus podager. About 1½ l'ne in length.

CASE XI. The preceding three species are all distinguished by the curious thickening of the second pair of legs to which we have above alluded. They have, also, all got more or less of the knobs or projections upon them which often accompany the thickened legs. The last species, which we have called podager, will be easily recognised by the figure. It is fawn coloured, and nearly 2 lines in length. From the mouth being under the projecting body, this may probably be taken as the type of a new section or genus.

Genus UROPODA (*Latr.*).

The chief character of this genus is the existence of a cord attaching the mite to the beetle on which it is found. The other characters are like those of Gamasus, only slightly modified by the buckler-like form of the body, which also entails a shortening of the legs.

Nos 11, 12 UROPODA VEGETANS.—**11.** Magnified sketch of ditto; **12.** Specimens.

Uropoda vegetans.
Half the size of a small pin's head.

The young naturalist is sure to be puzzled with this species; when a beetle is infested by it, it seems covered by a multitude of minute fawn-coloured shining convex scales (convex above and flat below) gummed on to various parts of the under side of the beetle, like tortoises or cocci, allowing none of the parts of the body they cover to be seen. They are not easily detached, and when by washing or scraping they are made to move, they do not fall off, but still hang on to the place where they were fixed, by a fine thread, which is attached by the one end to the beetle and by the other to the under side of the Uropoda. The older natu-

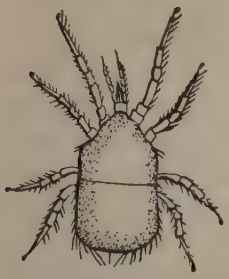
CASE XI. ralists, De Geer, Latreille, &c., thought that this was something of the nature of an umbilical cord, by which the mite drew nourishment from the beetle, or from others of its own species, on which it might be fixed, for they are sometimes found in clusters, one piled above the other. Others imagined that it wa. a silken cord by which the parasite attached itself so that the beetle could not get rid of them by brushing them off. The latter may be the purpose of it, but it is neither an umbilical tube nor a silken cord. Examination of the cord shows that it is not silk, and not a tube, neither can it be used in any way for conveying nourishment, for the mite can, at will, detach itself from the beetle. De Geer knew this, but supposed it was the end of the cord next the beetle that became detached. He says that they are able to remove when they please by crawling in a certain direction until the cord is sufficiently strained to cause the end to be detached from the beetle. This is a mistake: it is the end of the cord next the mite that becomes detached. Dugés ascertained its real nature. He says that he has found the Uropoda free under stones in bad weather as well as fixed to burrowing beetles. The pedicle or cord he describes as a horny filament, stiff, elastic when dry, soft, becoming flexible in water without dissolving; and in it there is to be found neither cavity, nor fibres, nor any organic structure. Fixed firmly on the coat of the beetle by a sort of spreading base, it is attached to the mite at the other end by a similar base, which exactly covers the anus of the mite, which, as in the other Gamasidæ, is situated on the under side, a short distance within the posterior margin of the body; and hence he concluded that it is not a silken matter spun by special organs, but the viscous and dried excrements of the animal, and of which it can get rid whenever it makes a new excretion.

Dugés knew only one species, but we have two or three from beetles in different parts of the world which differ in the proportions of the buckler or back, some being more rounded or more oval than others. In other respects they all look very much alike.

CASE XI.

Genus Zercon (*Koch*).

Koch describes and figures a genus under the name of Zercon. It has parallel sides, and a transverse line across the middle. We give a copy of his figure.



Zercon dimidiatus (copied from Koch's figure). About the size of a pin's point.

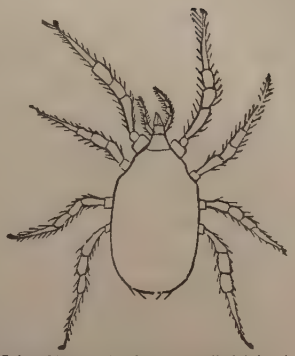
Genus Sejus (*Koch*).

Without any separation on the back between the thorax and abdomen, and without any soft portion exposed behind.

This is a genus of Koch's which we adopt with satisfaction for a well-known portion of the Gamasidæ, which is usually referred by naturalists to the genus Dermanyssus. Deducting Koch's two genera, the Gamasidæ above noticed are limited to those Gamasidæ in which the body is enclosed in whole or in part in a chitonous skin. They are all parasitic on insects. There are other species which have the skin soft and not chitonous, for which the genus Dermanyssus was established, and its original type was a species (D. avium) that infests fowls. But there are many species of soft-skinned Gamasidæ whose affinity is greater with those that are parasitic on insects than with those that feed on warm-blooded animals. We find it a great convenience to remove these from the latter, and to bring them alongside Gamasus; but in a separate group confined to the soft-bodied species that are either parasitic on insects or found free. The other characters by which they may be distinguished from Dermanyssus are, that the posterior two pair of legs are placed further back than in that genus, the body less elongate, and not so swollen behind. The facies of the two are sufficiently distinct: Dermanyssus reminds us of Ixodes, with which its habits correspond; Sejus reminds us of Gamasus, with which its habits agree. Dermanyssus will then be confined to the soft-bodied Gamasidæ parasitic on warm-blooded animals.

CASE XI. SEJUS VIDUUS (*Koch*, Übers., p. 92, t. x. f. 50).

The shoulders longish, rounded behind and without projecting bristles.



Sejus viduus. The size of a small pin's head.

It is to this genus doubtless that another species found by M. Dugés upon the leaves of Bindweed should be referred. He had gathered a quantity of these leaves on account of the great number of Tetranychi with which they were covered, and among them he found also a certain number of what he has named the Dermanyssus of the Bindweed; they walked freely upon the water where these leaves were soaking. Their size, their general form, that of the feet and the palpi, resembled those of the Dermanyssus avium; but their colour was of a greenish grey, and the intestines, and even the prolongations of its feet up to the sixth joint, were full of a green matter. He asks, was this matter the result of the suction of the vegetable juices directly from the leaf itself or indirectly from it after having been first swallowed by the Tetranychi on which the Gamasi fed.

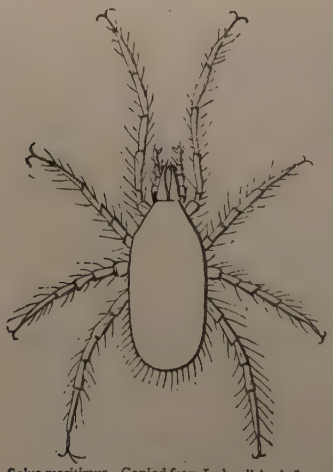
The same difficulty as to their food occurs in a species which M. Megnin has described (Insectologie Agricole, 1868) under the name of the Forage mite, which is found in great quantities among old hay, and which, when shaken down from the rack on the head and neck of the animals feeding on it occasions them considerable annoyance.

The species of this genus infest various insects as much as the other Gamasidæ of which we have already spoken, and many species also occur in all sorts of places, and some of them even lead an amphibious or semi-marine life.

In the species with such habits, we naturally feel a more particular interest, for mites being land animals we may expect to find

CASE XI some peculiarities of structure in those that have deviated into an aquatic mode of life, and still more when the aquatic mode of life is marine. No other insects have ever been found inhabiting the sea; certain beetles indeed live under high-water mark, but they are no more sea-beetles than divers are sea-men. Both are terrestrial, and their existence under the sea is exceptional, and provided for in both by special contrivances for breathing. Some mites that have of late years been described as found in the sea, are the nearest approach that we have to insects living in the sea.

The first notice we have of any with this peculiarity, either real or supposed, is one which, in 1842, M. Dujardin is said to have found under the sea. It seems to have belonged to this group. Next, three species were described and figured some years ago by M. Laboulbène (Ann. Soc. Ent. Fr. 1851), which had been found (like the above) living between tide marks. He named them Gamasus salinus, G. maritimus, and G. halophilus. The accompanying wood-cut represents his G. maritimus. They all live in the chinks of rocks that are submerged at high water. M. Laboulbène says that the two first like to congregate together in great numbers, which may perhaps be partly owing to a whole colony of eggs having been deposited at the same place. These two have a series of tooth-comb-like appendages on the third and fourth articles of the palpi, which are suggestive of the raptorial palpi of the Trombidiidæ; but the curious prolongations or excrescences which occur in other Gamasi (as in G. tetragonoides) forbid our attaching so much



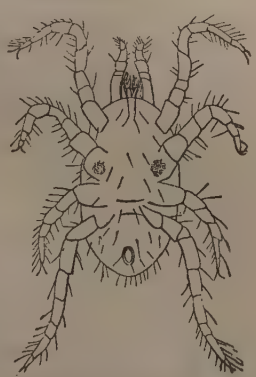
Sejus maritimus. Copied from Laboulbène's figure. Very minute.

CASE XI. importance to them as we otherwise should have done. One of M. Laboulbène's species (G. halophilus) is imperfect, the palpi being wanting. It looks very like M. Hermann's Trombidium celer, and it may prove a Trombidium when its whole structure is known. In the meantime it has this amount of resemblance with them, that when in life it is said to have been of a fine red colour.

Mr. Brady, of Sunderland, has recently added the following quasi-marine species to those above spoken of, which he has described under the name of G. marinus.

No. 13. SEJUS MARINUS (Gamasus marinus, *Brady*, Proc. Zool. Soc. 1875). **13.** Enlarged sketch of ditto, copied from Mr. Brady's figure.

Found pretty commonly in crevices of magnesian limestone rocks, between tide marks near Sunderland; Mr. Brady has also a specimen that was washed from among the roots of algae dredged off Cumbrae in the Frith of Clyde. It is very like, but distinct from, one of the species described by M. Laboulbène, and both it and they are obviously a parallel case to the species of Æpus, Trechus, Bembidium, and other beetles that have been found in similar places.



Sejus marinus. (Copied from Mr. Brady's figure.) Very minute.

SEJUS AURIS (Gamasus auris, *Leidy*, Pr. Ac. Phil., 1872).

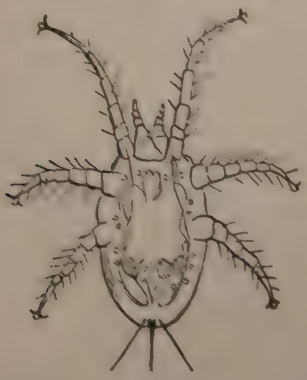
Professor Leidy describes a species under this name from the ear of an ox. He gives a figure of the claw to prove that it is a Gamasus, but no figure of the insect itself. A copy of his figure of the claw will be found on page 157.

Genus HALARACHNE (*Allm.*).

Nos. 14, 15. HALARACHNE HALICHÆRI (*Allm.*, Ann. Nat. Hist. 1847).—**14.** Enlarged figure of larva of ditto; **15.** Enlarged figure of perfect insect.

This is another claimant to the title of ocean mite, whose claim

CASE XL cannot be allowed. It is an extraordinary species of mite, which was found on the posterior nares of the seal named Halichærus gryphus, in the Irish seas. Both larvæ and perfect insects were found in abundance; we give copies of the figures, which will save description. It is no doubt most interesting and most



Halarachne halichœri. larva.
Copied from Allman.

Ditto, perfect insect.
About ½ of an inch in length.

curious, but it is not an ocean mite, any more than the seal on which it is found is a fish. It is merely a parasite on an amphibious mammal, which spends much of its time in the sea. Notwithstanding the name which he imposed upon it, Professor Allman, whose acute discrimination of affinity is second to none, at once referred it to its proper place. In fact, as soon as he got possession of the young mites there was no room to doubt—they are soft-bodied Gamasi (Seji), as plain as possible, but the perfect mite would have been much more puzzling. Guided by the light of the larvæ, we see that it belongs to this section of Gamasidæ, although the elongate form of the perfect insect suggests an approach to the Dermanyssi, and notably of one nearly if not quite as long and narrow as itself, that is found in the nostrils of the common goat-sucker. It is curious to speculate on the causes which led to the selection respectively by two species of

CASE XI. the same genus of the same place of abode in two animals living under such different conditions, a selection apparently followed or attended by a certain similarity of appearance, due no doubt to the equally restricted and confined limits of their place of abode. We can imagine the Gamasus of the animal that became a seal, being driven to take shelter in its nostrils to escape from being drowned by the washing of the seas, to which it would be exposed if it stuck to any unsheltered part of the body; and the Dermanyssus of the nostrils of the goat-sucker may have taken refuge there as its only place of secure retreat from the danger of being scratched off by the pectinated claw of its host.

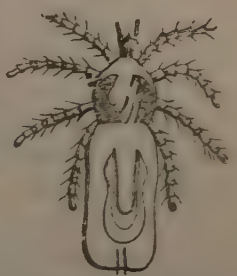
Sub-family DERMANYSSIDÆ.

Genus DERMANYSSUS. (*Dugès.*)

Soft-skinned; parasitic only on warm-blooded animals.

No. 16. DERMANYSSUS NITZSCHII (*Giebel*, in Zeit. ges. Naturw. iv. 29).—**16.** Enlarged figure of ditto, copied from Giebel's figure.

This is the species from the nostrils of the goat-sucker, of which we have above spoken. It feeds on the blood of its victim; it is as big as a head-louse, and as many as twelve to fifteen were found together in the nostril of the same bird.



Dermanyssus nitzschii. About the size of a head-louse. Copied from Giebel.

Nos. 17, 18, 19, 20, 21. DERMANYSSUS AVIUM (*Dug.*)—**17.** Enlarged figure of ditto, empty; **18.** Specimens thereof; **19.** Vignette of chickens (realistic chick); **20.** Enlarged figure of ditto fed; **21.** Specimens thereof.

The so-called "tick" that infests domestic poultry, canaries, and other cage birds. It lives especially in fowl houses, and on their

CASE XI. inhabitants, and they sometimes migrate from the birds to the persons of those who have charge of them, and occasion them much annoyance. Alt (a German observer) saw these mites, or a mite which he supposed to be of the same species, upon the neck and

Dermanyssus avium, full fed (upper side). Ditto, empty (under side).
About the size of the cheese mite.

arms of a cachectic old woman. According to him they were white, of the size of a grain of sand, extremely agile, and slipped out of little excavations (occupying the space of $1\frac{1}{2}$ square line), ran over the skin, and back again into their holes.

Simon narrates a case in which the mite nestled upon the skin of a woman, who was otherwise healthy. She was constantly infested with little louse-like animals, notwithstanding great cleanliness and many attempts at extirpation of the mites, which were recognised by Erichson as the Dermanyssus avium. It was found at last that the woman went several times daily into the cellar, over which the hen-roost lay. As often as this was the case, the fowls flew up into their roosting-place, and by this means the woman was sprinkled with mites. The removal of the hen-roost cured her of her supposed phthiriasis. (Kuchenmeister, Manual Parasites, vol. 2, p. 64.)

It also infests dove-cotes; although no doubt it is sometimes

CASE XI.

confounded there with the Argas reflexus, which is more specially assigned to pigeons.

It may be most easily observed in the cages and aviaries of singing birds, and they may harbour there, even although the most scrupulous cleanliness is exercised, especially if the perches used for the birds are made of hollow canes, and not solid wood. It is in these hollow canes that they most particularly harbour, and we may generally find them there at all seasons of the year. But it is very probable that, although it is in these recesses that we find them when we seek them during the daytime, they sally out during the night, and settle on the sleeping birds, in order to suck their blood. That they do so, is shown by their digestive organs being generally full of it in all individuals, both young and adult. It is this blood which gives to these animalcules their colour, which is dark purplish or brown, when they are filled; when empty, they are colourless. In the same retreats, are found a multitude of excessively fine exuviæ, or white cast skins, attesting sufficiently numerous moultings. In this heap are seen also colourless eggs, ellipsoid, nearly equalling in length the fifth part of the adult animal, which is scarcely a third of a line at the most.

These eggs are said to become larger in maturing, and to take gradually, like those of the spiders, the form of the young one which is coming out. The young have only six feet; the body is much longer and more inflated than that of the individuals of the same size which have already their eight legs; these last are slenderer, and more agile, and the posterior pair are much longer than the body, and continue pellucid and colourless as at first; but it is not long before they go and fill their stomachs, and the blood that they swallow makes them bright red at first, then dull, then brownish, in proportion as it becomes more altered and digested.

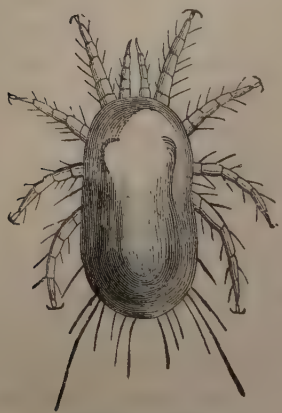
Bory de St. Vincent (Ann. Sc. Nat. 1st Ser. xxxv.) relates that a woman of forty years old, who felt the most intolerable itching

CASE XI. all over her body, had only to scratch herself to see minute mites come out of her skin, but none of them spread to, or propagated the disease to, her attendants. Gervais named this species Dermanyssus Boryi, *in compliment* to the narrator.

DERMANYSSUS HIRUNDINIS (*Hermann*, Mem. Apt. 84.)

About the size of a large pin's head. Found on the swallow with other vermin.

No. 22. DERMANYSSUS PIPISTRELLÆ (*Gerv.*, Ann. Sc. Nat. 1841).—**22.** Enlarged sketch of ditto, copied from Gervais' figure.



Dermanyssus pipistrellæ. Copied from Gervais' figure.

The Dermanyssi are not absolutely confined to birds—they are also found upon bats. The present is a species found upon the smallest of European bats (Vespertilio pipistrellæ). It is very like the common bird species, but more oval, and the colour (reddish brown) is more diffused.

It would even appear, from M. Dugés' observations, that some species attack snakes also. He speaks of two so attacked that had come under his observation; one, the common Coluber natrix, which he kept domesticated for several months, and which perished exhausted by these parasites nestled under its scales, which all his efforts had failed to destroy.

There are other Dermanyssi found on bats—new species from new countries almost always furnishing them, as well as new species of Pteroptus. Kolenati has described a number of these, and proposed various genera for their reception, under the names of Liponyssus, Ichoronyssus, Macronyssus, Lepro-

CASE XI. nyssus, Steatonyssus, and Pimelonyssus :—some of these are smooth, some heavy, others rough, and some with shields on the back and under side similar to those on the Pteroptidæ, to which these species have perhaps as much affinity as to the Dermanyssi, and Kolenati has made use of these differences to characterise his genera. We shall not follow him into these species. It may be a sufficient indication of their character to quote the names of the groups into which he divides them. He calls the whole group of Dermanyssi skin mites, and these he divides into the fat mites, the dirty mites, the big mites, the rough mites, the broken-shield mites, and the jointed-shield mites. We merely figure three of the principal types of these genera to give the reader an idea of them, but not having seen them or any carefully enlarged figures of their parts, we would refer the reader who wishes further information about them to Kolenati's own works. From Kolenati's figures and descriptions they seem to us (at least those with shields) to form a tribe apart midway between the Dermanyssi and the Pteroptidæ.

LIPONYSSUS SETOSUS (*Kolen.* Sitz. Acad. Wiss. Wien. 1859, p. 172.)

Liponyssus setosus. Copied from Kolenati. o'0012 of a Parisian metre in length.

Macronyssus longimanus. o'0007 to o'0011 of a Parisian metre in length

From the Rhinolophus euryale in Banat and Servia.

MACRONYSSUS LONGIMANUS (*Kolen.*, loc. cit. 178).

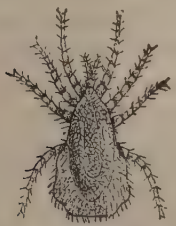
On Xantharpyia ægyptiaca in Egypt.

CASE XI.

LEPRONYSSUS RUBIGINOSUS (*Kolen.* loc. cit.).

Reddish white, chiefly found on Myotus murinus but also on all other bats that hibernate with it. Moravia and Silesia.

LEPRONYSSUS LOBATUS (*Kolenati*, loc. cit. 182).



Lepronyssus rubiginosus. Copied from Kolenati. 0·0008 of a Parisian metre in length.

Lepronyssus lobatus. Copied from Kolenati. 0·0015 of a Parisian metre in length.

Cherry red, and with an overlapping after-expansion, inclining to that of Periglischrus in the Pteroptidæ. On Myotus murinus in the Moravian Caverns.

PIMELONYSSUS BISCUTELLUS (*Kolenati.* loc. cit. 188).

Pimelonyssus biscutellus. Copied from Kolenati. 0·0015 of a Parisian metre in length.

This is one of the jointed-shield mites, the shield on the back is, as it were, cut transversely across the middle, and on the under side there is a corresponding fold which obviously serves as a hinge allowing the body to bend back and forward in a way that could not have been done had there been a stiff shield without joint. On Rhinolophus ferrum-equinum in the Golubaczer Cavern.

We shall conclude our notices of the Dermanyssi with a doubtful species.

No. 23. DERMANYSSUS(?) AGILIS (*Robin*), (MELICHARES AGILIS, *Hering*, Nov. Act. xviii.).—**23.** Enlarged figure of ditto.

Hering, who figures this species, says that it was found on old dates and figs along with Glyciphagus prunorum. The figures

CASE XI. given by him in his paper are in general very accurate and characteristic, especially considering the time when they were made; but this is not equal to the rest. There are various critical points left unnoticed, and amongst others the number of joints to the legs seems left uncertain. Professor Robin, however, before whose knowledge of this subject we bow, regards it as a Dermanyssus. If it be so, it must be one of the Gamasidæ which come under the genus Sejus, and ought to be removed from those that are parasites on vertebrate animals.

Sub-family PTEROPTIDAE.

Genus PTEROPTUS (*Dufour*).

Readily distinguished by their very thick, short, and conical legs, which are thicker and the joints shorter than in Dermanyssus. The majority of the species composing it are either more or less lozenge-shaped or baggy behind. All the species are parasitic on bats, to which they are confined, and they are sprinkled with bristles, which are jointed in a manner not unlike the hairs of the bats themselves.

The resemblance between the structure of the hairs of the bats and those of their parasites is certainly very remarkable. We give a comparative view of a different kind of each in illustration of this.

Magnified hair of a species of Vampire, after Queckett.

Magnified hair of Diplostaspis dasycnemi, a European Pteroptus.

Here of course there can be no question of the resemblance

CASE XI. being due to affinity, but the teleologist may perhaps say that it indicates that there is some condition of life shared by both, which makes it necessary or advantageous for the animals exposed to it to be so provided.

The genus Caris of Latreille was established upon the six-footed young of the Pteropti, and the names Celeripes and Spinturnia, given respectively by Montagu and Heyden, are synonyms of Pteroptus.

Kolenati has paid much attention to this group, and has published important contributions to our knowledge of its species in various works, of which the more important are "Die parasiten der Chiroptern," his "Bietrage zur Kentniss der Arachniden," published in the "Sitzungs. Akad. Wissenchaft. Wien," and various papers in other scientific journals, such as the "Wiener Entom. Zeitschr.," the "Stettiner Entom. Zeitung," the "Bulletin of Imp. Acad. Nat. Moscow," &c. In these he has described and figured many species and established so many new genera, that he found it necessary to make a separate family for the group (Pteroptidæ). We have thought a sub-family sufficient. His two most important new genera are no doubt rightly put apart—indeed we do not think that either of them belong to the Pteroptidæ at all—but the rest of his genera seem all very close to each other, and, although we note and figure them, it is for the reader's information, not because we believe them to be good genera.

The two genera (Otonyssus and Peplonyssus) which differ in a marked manner from the species among which Kolenati places them, are only six-footed, and therefore probably the young of some eight-footed species. The natural supposition would be that, being parasitic upon bats, they are the young form of some Acaroid parasite of that class of animals—such as Dermanyssus, Pteroptus, or Ixodes—and Pteroptus being, *par excellence*, the bat parasite, it is most natural that it should be the genus looked to. But there are such material differences here, and equally

CASE XI.

material resemblances elsewhere, that we feel constrained to remove them from the Pteroptidæ to the Sarcoptidæ, alongside of Myobia. When we come to them, we shall give our reasons for doing so more in detail.

The sub-family divested of them may be divided into two sections, those which are so constructed as to attach themselves by the inferior margin of the body all round, like a limpet to a rock, and those which are not so organised. The first of these sections constitutes the genus Periglischrus of Kolenati, and is also characterised by the posterior end of the body being more or less baggy.

Section I.—ADHERING BY THE EDGE OF THE BODY.

PERIGLISCHRUS RHINOLOPHINUS (*Koch*. Arachnid, 38, tab. 21). (Periglischrus asema, *Kolenati*, Sitz. Ak. Wiss. Wien. 1858, p. 81).

Kolenati's species seems to be the same as Koch's. It is yellowish white in colour, and is found on Rhinolophus ferrum-equinum throughout Europe.

PERIGLISCHRUS CALIGUS (*Kolenati*, Sitz. Akad. Wiss. Wien. 1858, p. 79).

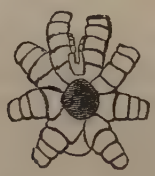
Periglischrus rhinolophinus. Copied from Koch's Ubersicht. o'0006 of a Parisian metre in length.

Periglischrus caligus. Copied from Kolenati. o'0011 of a Parisian metre in length.

A Brazilian species found on the wing of Glossophaga amplexicaudata. It is dull yellow.

CASE XI. TINOGLISCHRUS PUNCTOLYRA (*Kolenati*, Sitz. Akad. Wiss. Wien. 1858. p. 82).

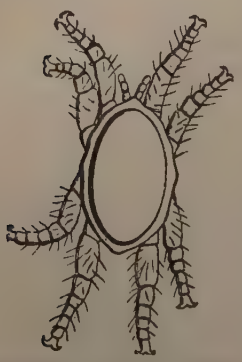
Tinoglischrus punctolyra. Copied from Kolenati. 0·0005 of a Parisian metre in length.



Do. underside.

This differs from Periglischrus in having the body attenuated both before and behind. It is found on Rhinopoma macrophyllum in Egypt.

No. 24.



Tinoglischrus audouinii. Copied from Audouin's figure.

TINOGLISCHRUS AUDOUINII.—**24.** Enlarged sketch of ditto, copied from figure by M. Audouin.

This species was found by Audouin on Rhinolophus unihastatus. It was described and figured by him in the Annal. Sc. Nat. 1832, but without name. We have appended his own to it. There seems little doubt that it belongs to this section and this sub-genus.

Section II.—NOT ADHERING BY THE EDGE OF THE BODY.

Almost all the species of the genus Pteroptes have, in some form or to some extent, a horny shield over the upper or under side of the body, and this applies both to this and the preceding section. The latter, being small, called for no further subdivision, and in it no genera have been proposed founded upon variations in these shields. In this section, however, Kolenati has used them as characters for a number of genera that he has founded

CASE XI. upon them. Of those that have a single shield on the back and none on the belly, he makes the genus Monostaspis. Those that have one shield on the back and one on the belly, he makes Diplostaspis. Of those that have one on the back and two on the belly, he makes Tristaspis. Those with a divided shield on the back and one below, he calls Heterostaspis. One that has remarkably thick anterior legs, with the claws developed into something like an anchor without a caruncle, he calls Leiostaspis, and so on. These have all very much the same facies, and require careful examination to distinguish them from each other. For our purpose it will be sufficient to notice the commonest and the most remarkable.

The commonest is perhaps:—

Nos. 25, 26. DIPLOSTASPIS VESPERTILIONIS (Acarus vespertilionis, *Herm.* Apter. p. 84, pl. 1, fig. 14, 1804; Pteroptus vespertilionis, *Duf.* Ann. Sc. Nat. 1832; Sarcoptes vespertilionis, *Koch.* in Herrich-Scaff. Ins. Deutsch. Heft 167, tab. 23; Dermanyssus albatus, *Koch.* Deutsch. Crust. Myr. and Arach. h. 24, 168, 5 (young state); Dermanyssus arcuatus, *Koch.* id. op. h. 24, 168, 2; Diplostaspis arcuata, *Kolenati*, Sitz. Akad. Wiss. Wien. 1858, 166).—**25.** Enlarged figure of ditto; **26.** Specimens of ditto (1 slide).

Diplostaspis vespertilionis.
Copied from Hermann's early figure.
Half a line in length.

Ditto (D. arcuata Kol.)
Copied from Kolenati's better and later figure.
0·0015 of a Parisian metre in length.

Yellowish cream coloured, with dark or purplish markings; very frequent on Panugo noctula throughout Europe. We have noted what appear to be synonymes given to it by various authors.

CASE XI LEIOSTASPIS ZELEBORII (*Kolenati* in Sitz. Akad. Wiss. Wien. 1860, Ancystropus zeleborii, *Kolenati* in Parasiten der Chiroptern, p. 25).

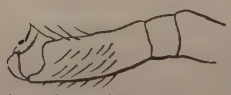
Leiostaspis zeleborii. Copied from Kolenati's figure. 0·0069 of a Parisian metre in length.

Dull yellow, with brown legs, and blackish markings. Found on the eyelids and eye corners of Xantharpia ægyptiaca (seed eating bats) in Egypt; not rare.

Sub-family ARGASIDAE.

Genus ARGAS (*Latr.*).

The skin in this genus is leathery and flexible, but not smooth, being coarse and covered with granulations or depressions. The anterior part of the body projects over the mouth, so that none of its parts are visible at least in the perfect insect. The first joint of the palpi is larger than the rest.



Leg and claw of Argas reflexus.

In some species the joints of the legs are more or less nodose, and in the perfect insect there are no caruncles to the claws of the tarsi, although in the young there would appear to be so, at least they are so figured in Audouin's drawing of the young of Argas pipistrellæ.

No. 27 ARGAS PIPISTRELLÆ (*Audouin*, Ann. Sc. Nat. 1832).—**27.** Enlarged sketch of young of ditto from Audouin's figure.

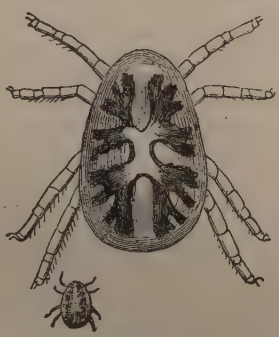
Argas pipistrellae (young, under side). Copied from Audouin's figure.

Claw of ditto. Copied from Audouin.

Found on the body of the little pipistrel bat, with its snout

CASE XI. deeply buried in the skin. The woodcut shows the young, which was the stage on which Latreille's genus Caris was founded.

No. 28. ARGAS REFLEXUS (*Fab.*), (Rhynchoprion columbæ, *Herm.*).—**28** Enlarged figure of ditto.



Argas reflexus.
Magnified and natural size.

The present species occurs on pigeons (whence it was named Rhynchoprion columbæ by Hermann). It is chiefly met with in the south of Europe. In the north it does not appear to be very frequent; although, no doubt, if search were properly made for it, it would be found much too common. Some years ago it was found swarming in a house in Frankfort, and latterly (1872) has been detected by Mr. Gulliver on pigeons near Maidstone, in Kent (Quarterly Journ. Microsc. Soc. and Ann. Nat. Hist. 1872).

No. 29. ARGAS PERSICUS (*Fisch.*).—**29.** Enlarged figure of under side.

In Persia the present species has long been known and dreaded as an annoyance. It is there called Malleh de Mianeh, and has been noticed by travellers under the name of Teigne de Miana, or venomous bug of Miana. It lives in houses, and it is reported that its puncture occasions disagreeable or even serious consequences to man—producing convulsions, delirium, sometimes followed by gangrene of the part, and, as is asserted, even death—a statement which it is now said is very much exaggerated, if not wholly incorrect. The body is flat and thin, of a clear blood-red, spotted on the back, with a great many white spots or granulations. The feet are pale yellow.

CASE XI. No. 30. ARGAS AMERICANUS (*Riley*).—**30.** Enlarged figure of ditto.

Found in Texas along with the common cattle tick (Ixodes bovis), but has not yet been recorded as troublesome to man.

Argas Miniatus. Copied from Koch.

Its form is similar to that of the Persian species, but the granulations are smaller, and on the back radiate from a central point outwards, especially behind.

ARGAS MINIATUS (*Koch*).

Said by Koch to be from "Damarara" (whether intended for Demerara or Damara Land not known).

No. 31. ARGAS MOUBATA (*Murr.* n. s.).—**31.** Enlarged figure of ditto.

This insect is a native of Angola. Specimens were brought home by the late lamented Dr. Welwitsch, and it is figured from those in his collection.

Argas moubata (magnified and natural size).

It is called by the natives Moubata, and we have preserved the name. It attacks both man and beast, and, according to Dr. Welwitsch, gets at man in bed like a bug. The pain of its bite is not felt until two hours after it has been inflicted, but it makes up for the respite by continuing painful and inflamed for from twelve to twenty-four hours thereafter. It is oblong, coriaceous, coloured something like a shark's skin, or slate-colour, speckled with white spots or granulations all over it, which are larger and more dispersed than in the other species.

It is obviously akin to the Argas Savignii of Egypt, which, however, does not, from the figure in the "Description de l'Egypte,"

CASE XL

appear to have the paler spots or granulations of this species. The colour of A. Savignii is not mentioned in the description.

No. 32. ARGAS (ORNITHODOROS CORIACEUS) (*Koch*).· **32** Enlarged sketch of ditto, copied from Koch's figure.

Argas (Ornithodoros) coriaceus. Copied from Koch.

Koch, in his "Ubersicht," proposes a genus under the name of Ornithodoros for those species of Argas that have eyes. We have already pointed out the insufficient nature of this character, and therefore hesitate to adopt it.

The present is the species on which he founds it. The front is a little projecting; the colour is pale yellowish brown, with vermilion spots speckled over it. It is from Mexico.

No. 33. ARGAS (ORNITHODOROS) TALAJE (*Guer.*).—**33.** Enlarged figure of ditto.

Argas (Ornithodoros) talage. Copied from Guerin.

A very irritating substitute for, or rather addition to the flea, in Guatemala. M. Sallé, the well-known French entomologist, who collected largely in Central America, thus describes the annoyance caused by this insect :—

"Being at Casa Vieja de Gastoya, on the road from Guatemala to Zacapa (Central America), about fifteen leagues from Guatemala, the 6th of May, 1847, I was awakened several times out of a profound sleep by atrocious itching on the hands and face, and my companion, M. Jules, suffered still more than I did. At three o'clock, irritated by these painful bites, I lighted a candle, and found that I had

CASE XI. my hands covered with blood and blotches like large bites of bugs, which I supposed must belong to some particular species of monstrous size. My companion told me that we had been stung by wasps lodged in the walls of the house. On arousing the muleteer who conducted us, he told us that we were the victims of an animal called Talaje, which they considered a large flea. On seeking for the insect, I found this Argas, which appeared to me very disgusting. Some were distended with blood, others had the skin rugose and wrinkled. I then remembered having taken some of them on my face during the night, and having rolled them between my fingers, taking them for some of the ticks with which my mule was covered to such a degree that some people told me it would be killed by them.

"These Talajes keep themselves in the crevices of the walls of old houses. These walls are made of bamboos, roughed with mortar. They bite like fleas, and return to their holes before morning, for they are nocturnal. My hands and ears were much swollen, and I suffered horribly. On piercing some of the pustules full of blood occasioned by these, a drop of blood issued. I washed myself, and put in the water some drops of volatile alkali, but in place of allaying the pain, that only added to the swelling and inflammation.

"M. Jules did nothing, and suffered as much as I did, only the swelling was less, and did not last so long." M. Sallé passed two bad feverish nights after this. On the third he began to get better, but it was not until a fortnight afterwards that he was entirely cured.—*Rev. Mag. Zool.*, 1849, 342.

The figure is copied from Guerin, and from its appearance it seems not unlikely that it may belong to the same section as the preceding.

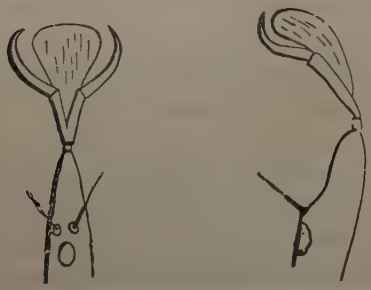
An insect belonging to this group has been described under the name of Eschatocephalus gracilipes. It is said to be only an aberrant form of Argas.

CASE XII.

Family IXODIDÆ (Ticks).

In this family the body is covered by a tough, smooth, leathery skin, which, in the female, is capable of much extension. The rostrum and mandibles are adapted for sucking. They have valvate palpi sheathing the rostrum, which is composed of two lateral parts, and a middle part covered with recurved barbs, which prevent its retracting when once driven into the flesh; but Professor Busk ascertained by his researches on the living young of the Catapato (Amblyomma rotundatum) that the sucking

Rostrum of Ixodes. Copied from figure by Audouin.



Claw of ditto. Copied from figure by Megnin.

apparatus (in it at least) lies not in the middle part or rostrum, but in the mandibles on each side of it, up each of these run two tubes designed for this office. The feet terminate in two claws, and a caruncle or vesicle which acts as a sucker. An important

CASE XII character is their having a small carapace or shield on the back behind the head. Some have eyes, and some none. The habits of the species must at first be herbivorous, for it is from the herbage that they find their way to the creatures on which they fix; but when mature, they greedily avail themselves of every opportunity of settling on vertebrate animals, whose blood they suck instead of sap. It is a remarkable feature in the economy of these minute animals, that the same species at different stages of its life should thus be at one time phytophagous, and at another carnivorous. The usual special adaptation of structure to kind of food would seem to be absent, but the anomaly is only apparent. Carnivorous mammals are provided with a different apparatus for obtaining their food from that of vegetable feeders; not no account of the difference in the chemical constituents of their food, but on account of the different form in which it is presented to them for consumption and assimilation. If, for example, the food of both was presented to them in a liquid state, in the one case blood, and in the other juice of plants, we may be sure that the carnivorous canines in the one case, and the vegetarian molars in the other, would be alike dispensed with, and both would be furnished with a sucking-up or pumping apparatus, which might be identical, if no speciality in the mode in which the liquid presented itself called for a difference. There might be a difference in the structure of their viscera, adapted to the chemical character of the liquid food, but there is no teleological reason why the external and oral structure should not be the same in both. This is what we find in all suctorial insects—bugs, gnats, acari, &c. All are provided with a sucking apparatus, constructed on a similar plan, which some use upon animals, and others upon plants. It has been even said that some, as the bed-bug, feed upon the juice of plants and blood of animals indifferently, and the impossibility of immense swarms of mosquitoes ever tasting food at all in the perfect state, if they are restricted to the blood of mammals, has been adduced as an argument in support of their doing so too. It is to

CASE XII. be remembered, too, that in some of these blood-suckers, as the mosquito, it is only the female that attacks us, or indeed that is provided with the sucking apparatus, and there is a very good reason for this. The mission of the male is done as soon as he has impregnated the female, and he may get about his business, and die as soon as he pleases. Nature has no further use for him; but the female has still to lay her eggs, therefore she must be fed. In like manner so is only the female tick that we find with its large abdomen distended with blood. The abdomen of the male is not capable of distension like that of the female.

Eyes are absent in many species of this genus (for example, in our own ticks), but present in others.

The group is very homogeneous, and although there are various types that may serve for subsections, it does not appear that as yet any very good sectional characters have been found to enable us to break it up, and distribute its numerous species into genera. Koch has tried to do so by the eyes; thus he reserves the name Ixodes for those without eyes; then he makes a genus Hyalomma for those with clear distinct cone-shaped eyes, and palpi as long or longer than the head; one named Dermacentor, with small flat moderately clear pale eyes, and very short broad palpi; one named Amblyomma, with flat muddy dull pale eyes. Starting from these, he uses other characters to differentiate the species still farther; Hæmalastor has the eyes of Hyalomma, but the body straight in front, without any emargination for the reception of the head, and very long hind legs, and the whole upper surface covered by the shield; Rhipicephalus has the eyes of Amblyomma, but with the palpi as broad as long, and with an external angle, and so on. But we have already seen the little value of the eyes as a character in some of the other groups, and the whole family is so homogeneous, especially the females, that although some of Koch's sections may be of use as artificial aids to the recognition of species, we cannot regard them as of much

CASE XII.

use in arriving at a correct view of their natural relations to each other. Notwithstanding this we shall for the sake of facilitating the task of any one who may be disposed to make a study of the family, give, in their natural places, a figure of each of Koch's genera above mentioned. There seems to be at least three pretty well defined types of form. The oblong oval one that we have in this country, and which extends over the whole of the northern temperate regions, which may be regarded as the true Ixodes, the more orbicular species like a coin, generally with eyes, almost exclusively tropical, and principally composed of Koch's genus Amblyomma, and the small, very flat variegated species, which as yet have only been found on snakes.

The Ixodidæ that we have in this country live in woods and herbage, and attach themselves to different animals as they pass; from sucking the blood, the body of the female swells in the form of a pea or bean. It has indeed often been supposed that they are actually parasitic on the animals on which they are found, and that a separate kind is appropriated to each animal, and that they breed either upon them or about them. Thus, one is called the dog-tick, another the cattle-tick. One of the American representatives is called the ox-tick (Ixodes bovis), and Leach described six British species, one as being appropriate to the swallow, another to the hedgehog, two to dogs, another to dogs and hedgehogs, and a sixth (Nycteribia), which turns out to belong to another order (the flies), to the bats. It is an undoubted fact also, that vast numbers of the present species have been found in dog-kennels, swarming so in the chinks of the wood, as to render it necessary to pull them down and burn them. Nothing, however, in this is inconsistent with the natural habitat of the ticks being in herbage and foliage, or with their being carried by dogs or cattle from their proper habitat to the places where they live, and there propagating themselves.

There is no getting over the fact, which every one accustomed to a country life knows, that dogs will go out in the morning

CASE XII. perfectly free from ticks, and after a few hours' hunting or rambling come home with a quantity upon them; that cattle and horses combed and curried and sent out to grass clean are soon loaded with them; and that man himself, especially in haytime, is often seriously annoyed by them. So far then as regards our British species, it is impossible to suppose that they are bred on the creature on which they are found.

It is to be noted, however, that a good many exotic species show indications of being limited to one animal, and even of passing their lives upon them: some of these have been taken no where else but from between the scales of various serpents from warm climates, such as the python, the boa constrictor, etc., living (or dying) in captivity in menageries, etc. These of course have come with them from their native countries; but none of them have as yet been found on any other animal from these countries—an exception which loses some of its force when we remember that no animal is so helpless and powerless to get rid of ticks as a serpent, especially when they once get between its scales. It may be that, nevertheless, this section has some special habit adapting them for attachment to scaley reptiles. They are all of a flat circular type, admirably adapted for getting between the scales, and in their very colour they imitate the colours of the serpents on which they live. To be sure that colour is usually that of tangled herbage, but other species of Ixodes have not this combination of colouring. On these accounts we propose to make a separate section for them under the name of Ophiodes; although, so far as we yet know, there are no other characters by which to separate them.

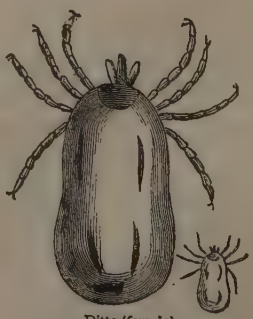
Another case in which it seems probable that ticks are truly assigned to one class of animals, is where they are found on bats. Kolenati has described some half dozen species as peculiar to them, and it is very probable that they are so, for not only have they been found nowhere else, but the most of them are distinguished by a special character, namely, the possession of long and slender

CASE XII. legs. It is to be noticed. too, that two specimens of a species of Ixodes (named Ixodes longipes by M. Lucas—Bull. Soc. Ent. Fr. 1872); were lately taken in one of the subterranean caverns of the Pyrenees, viz., the upper cavern of Mas-d'azil in the Ariège and it, too, was distinguished by the length and slenderness of its legs. There can be little doubt, we imagine, that they were individuals that had dropped from some bat that had made the cavern its place of retreat; and it is, perhaps, not wholly irrelevant to remark that disproportionate length and slenderness of the legs is a very common modification of the parts in blind insects inhabiting such caverns: for example, Anopthalmus, Aphænops, Leptoderus, etc.

Genus IXODES—without eyes.

Nos. 1, 2, 3, 4, 5, 6. IXODES ERINACEUS (*Aud.*, Ann. Sc. Nat. 1832).—**1.** Enlarged figure of male; **2.** Specimen of ditto (5); **3.** Enlarged figure of female, half fed; **4.** Specimen of ditto in phial, ditto (11); **5.** Enlarged figure of female, full fed; **6.** Specimen of ditto in phial (4).

Ixodes erinaceus (male). 1¼ lines in length.



Ditto (female). Magnified and natural size.

This is a common species in Britain, and is found in rough herbage, woods, and on dogs, cattle, foxes, hedgehogs, &c. It is, we believe, the species that is commonly, although erroneously, taken for Ixodes ricinus, at any rate generally known as the dog tick.

CASE XII. IXODES FODIENS (*Megnin*, Insect. Agric. 1867, p. 107). (I. pustularum, *Luc.*, Ann. Soc. Ent. Fr. 1866, Bull. lvii.)

Ixodes fodiens (female), under side. Magnified and natural size. Reduced from figure by M. Megnin.

This species appears to be nearly allied to the preceding. But in addition to its colour, which M. Megnin says is black, the legs seem to be placed at greater distances from each other. The difference in the form does not go for so much, because that depends in the female a good deal on the degree of distension of the body.

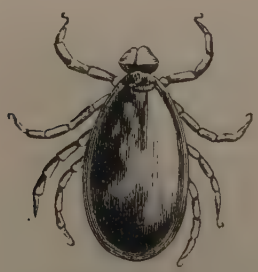
Its habits, or we should rather say, the results which M. Megnin relates as following upon its attack, are moreover quite different from anything that is recorded of any other species of Ixodes, and we cannot help thinking that they must have proceeded from some abnormal state of the health of the animal attacked, or from some special circumstances which do not appear in his narration. His account is as follows :—

"Towards the 15th of last June (1866) a mare, fifteen years old, belonging to Captain Pinard, of the 1st regiment of dragoons in garrison at Versailles, presented all at once a disease of the skin of a very unusual form, which affected the legs exclusively. This disease was characterised by a pustular eruption, which occupied the lower part of the limbs, without ascending above the knees or houghs, and was accompanied by much itching. Each pustule rested on a hard inflamed base, and was covered by a crust of dried purulent matter, which was easily detached, taking

CASE XII. along with it a bundle of hairs, and then disclosed a small ulcer. At the bottom of that ulcer, and completely concealed by the crust, the parasite was found, and it was clearly the determining cause of the pustule, because it healed up spontaneously as soon as the insect was removed; but as it would have taken too long to destroy all the individuals one by one in this manner, they were disposed of *en masse*, by lotions of an infusion of tobacco. Eight days after its appearance, the malady, thanks to this treatment, completely disappeared, leaving in the place of each pustule a small smooth white scar."

Previous to M. Megnin's publication, M. Lucas had given a preliminary notice of the matter to the Entomological Society of France, from M. Megnin's information, and stated that M. Megnin proposed for the insect the name I. pustularum, but he gave no description. M. Megnin would appear to have forgot this, and gave it the above name when he described it.

Nos. 7, 8, 9, 10. IXODES MARGINATUS (Leach) (testudinarius, *Murr.*).—**7.** Enlarged figure of male; **8.** Specimen of ditto (8); **9.** Enlarged figure of female; **10.** Specimen of ditto.



Ixodes marginatus (male). 1½ lines in length.

Ditto (female) unfilled.

We believe that this is the I. marginatus of Leach. The Ixodes marginatus of Fabricius is said to be Argas reflexus.

It also is a British species, and sometimes has swarmed in such great numbers on lawns and hay-fields, as to have made the

CASE XII. mowing and drying of the grass a very troublesome and disagreeable operation to the labourers. We imagine that this is the species spoken of by Mr. Gulliver as troublesome in Kent, and which he supposes to be Ixodes Dugesii.

No. 11. IXODES RICINUS (*Koch*, Arachnidæ).—**11.** Enlarged figure of ditto, copied from Koch's figure.

A great deal of confusion seems to exist as to which species is the true Ixodes ricinus of Linnæus. We have endeavoured to unravel it without much success. On examining the species in the Linnæan Collection in the possession of the Linnæan Society, we find that the specimens stand almost without exception unnamed. Among them, however, there is one (unnamed) that corresponds with Koch's figure of Ixodes ricinus, and we therefore fancy that that figure may be taken as representing the true ricinus.

No. 12. IXODES REDUVIUS (*Aud.*, Ann. Sc. Nat. 1832.).—**12.** Enlarged sketch of ditto, copied from Audouin's figure.

A French species, which comes near that which we have above-named marginatus.

No. 13. IXODES TRABEATUS (*Aud.* loc. cit.).—**13.** Enlarged sketch of ditto, copied from Audouin's figure.

Another French species, distinguished by the anterior half of the body being black, and the posterior red.

Nos. 14, 15, 16. IXODES BOVIS (*Riley*).—**14.** Enlarged figure of male; **15.** Enlarged figure of female; **16.** Specimen of ditto (1).

We have taken our sketch of the male from a figure given by Mr. Riley, in the appendix to Professor Hayden's Geological Report on Montana, Utah, &c., for 1872. And that of the female, from a specimen (No. 16) that we took off the neck of a miner in Utah, a portion of whose skin may still be seen adhering

CASE XII. to the rostrum. Koch has figured and described (in his Uebersicht) another American tick, under the name of Ixodes Americana (Acarus Nigua, *Deg.*) It is rounder and smaller, and is probably more confined to the southern districts. This latter is spoken of as being known in America by the name of *piques*, and as being very distressing, and sometimes dangerous to man and cattle. That it is very annoying is beyond doubt, especially where men habitually sleep and live in the open air.

Mr. Riley says of his species that it occurs in great abundance at times on cattle in the West, and in Texas and Central America, and that it had also been detected on a porcupine and on a hare, which is confirmatory of the view we have above taken regarding their habitat and habits.

It is probably this tick to which Captain Campbell Hardy alludes in his "Forest Life in Acadie" (1869). "A tick (Ixodes) affects the moose, especially in winter and early spring. The animal strives to free itself from their irritation, by striding over bushes and brambles. The ticks may often be seen on the beds in the snow, where moose have lain down, and whence they are quickly picked up by the ever-attendant moose birds or Canada jays (Corvus Canadensis). These vermin will fasten on the hunter when backing his meat out of the woods. The Indian says, 'bite all same as a piece of fire'" (p. 80).

Nos. 17, 18. IXODES BREVIPES (*Murr.* n. s.).—**17.** Enlarged figure of female of ditto; **18.** Specimens (2).

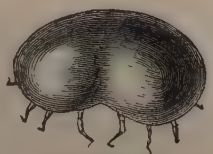
A rather broad and comparatively short species from Ceylon distinguished by the legs being more slender and shorter than in the allied species.

Nos. 19, 20. IXODES DISTIPES (*Murr.* n. s.).—**19.** Enlarged sketch of female of ditto; **20.** Specimen of ditto (1).

This is a species we have received from Tunis, and we made sure that we should find it described either in the "Description

CASE XII. de l'Egypte,' or in Lucas' entomological part of the "Exploration de l'Algerie." We cannot, however, identify it with anything there, and therefore have named it as above, provisionally. It is like, but more than twice the size of Ixodes erinaceus, at least the female is (which we have alone seen), and instead of having all the feet, as in it, close to the head, has a greater distance between their origins, a peculiarity from which we have given it its name.

Nos. 21, 22. IXODES TRANSVERSALIS (*Luc.*).—**21.** Enlarged sketch of ditto; **22.** Sketch of head of python, showing groove under eyebrow in which it is found.



Ixodes transversalis.

This is a species which was described by M. Lucas from specimens found in the deep groove under the eyebrow of one of the West African pythons kept in the menagerie of the Jardin des Plantes. It will be seen from the figure that it is very like the female of any common species of Ixodes, with the exception that the abdomen is transverse instead of longitudinal, and it suggests the idea that it possibly may be the same as one of these with the abdomen pressed into a transverse position from the confined and constrained situation in which the animal has been living. It would appear that it has been found more than once in the same spot of the python's head in different individuals, and never anywhere else, and if we imagine an ordinary Ixodes to fix itself in the groove below the eyebrow of the python, and to fill itself in that constrained position, the abdomen might certainly not have room to distend itself in the usual longitudinal direction, but be forced to spread itself sideways, and if the insect remains fixed for a sufficient time, the set of the abdomen might become permanent.

Genus SARCONYSSUS (*Kolen.*).

Terminal joint of the palpi rounded or oval.

CASE XII. SARCONYSSUS NODULIPES (*Kolenati*, Sitz. Akad. Wiss. Wien, 1860, p. 576).

Kolenati describes four species of Ixodes found on bats under the generic name of Sarconyssus, but we can find no difference in his characters from those of the typical Ixodes, except that above noted.

Sarconyssus nodulipes: Copied from Kolenati's figure.

The present species is distinguished by its long and slightly nodular joints, but another of his species has not long legs. It is pike-grey with brown legs and palpi. Found on Myotus murinus in Moravia. The other bat species of Sarconyssus, with one exception, also have long legs.

Genus HYALOMMA (*Koch*).

Eyes clear, distinct, and cone-shaped.

No. 23 HYALOMMA CORNUGER (*Kolenati*, Meletemata).—**23.** Enlarged sketch of ditto, copied from Kolenati's figure.

This, and two or three other species like it, occur in the

CASE XII. Caucasus and neighbouring regions. In form and appearance it is similar to a species from Syria, described by Koch under the name of Hyalomma syriacum, and from the locality it is possible that this too may belong to the section of Ixodes, to which he has given the name Hyalomma; although that section depends on its having eyes, of which Kolenati makes no mention.

HYALOMMA HISPANICUM (*Koch*, Ubers. Arach.).

Hyalomma hispanicum (male). Copied from figure in Koch's Ubersicht. Magnified and natural size.

Ditto (female) unswollen. Magnified and natural size.

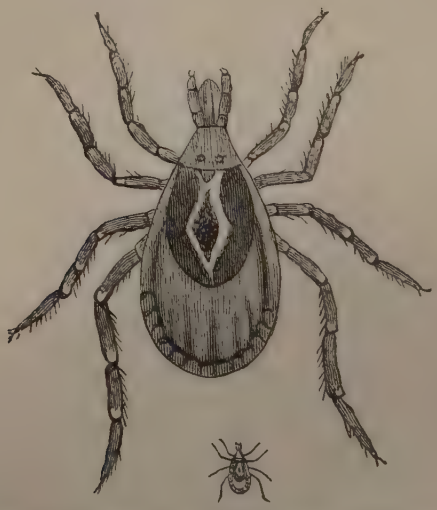
Dark wine red, with a thin margin of yellowish-white; legs light

CASE XII. red, the angles and tips of the joints whitish-yellow. From Spain and Portugal.

Genus HAEMALASTOR (*Koch*).

Body of male entirely covered by shield, no emargination in front, with conical clear eyes.

HAEMALASTOR LONGIROSTRIS (*Koch*).



Haemalastor longirostris. Copied from figure in Koch's Ubersicht. Magnified and natural size.

Leather yellow—scutellum brownish-red, with a lozenge-shaped blotch dark in the centre; legs brownish-red, with the tips of the joints yellow. From Brazil.

HAEMALASTOR GRACILIPES, *Frauenfeld*, Verhand. Zool. Bot. Gesellsch. Wien, iv. 28–9, (*Kolenati*, Sitz. Akad. Wiss. Wien, 1860; Eschatocephalus gracilipes; *Frauenfeld*, id. Band iii. 57 ♂; Sarconyssus hispidulus; *Kolenati*, Die Parasiten der Chiroptern, 1857, p. 22, ♀).

One of the species confined to bats. Found on Rhinolophus euryale, and other species in Hungary, Moravia, &c. It

CASE XII. is blood-red; the male sometimes reddish-yellow, or yellowish-brown. It is long-legged, like most of the bat species.

Haemalastor gracilipes. Copied from Kolenati's figure. 0·0023 to 0·0044 of a Parisian metre in length.

Genus DERMACENTOR (*Koch*).

With small, flat, pale eyes, and very short broad palpi.

DERMACENTOR PARDALINUS (*Koch*).

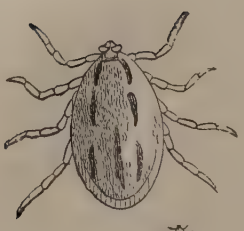
Oval; legs thick, the thighs of the posterior pair toothed below, rust-red in patches, in a sort of network of yellowish-white. From Hungary.

Dermacentor pardalinus. Copied from figure in Koch's Ubersicht. Magnified and natural size.

Genus HAEMAPHYSALIS (*Koch*).

No eyes; palpi very small, almost broader than long, three-cornered, the posterior margin of the second joint expanded outwards.

CASE XII.



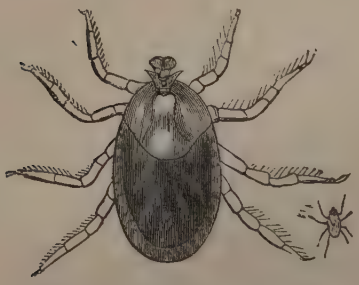
Haemaphysalis rosea. Copied from figure in Koch's Übersicht. Magnified and natural size.

HAEMAPHYSALIS ROSEA (*Koch*).

Shining yellowish-red; palpi and legs yellow; scutellum blood-red; abdomen with three elongate grooves. From the West Indies.

Genus RHIPICEPHALUS.

Eyes flat and muddy; palpi as broad as long, and with an angle on the external side.

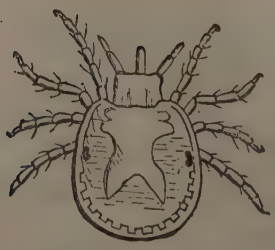


Rhipicephalus senegalensis. Copied from figure in Koch's Übersicht. Magnified and natural size.

RHIPICEPHALUS SENEGALENSIS (*Koch*).

Flat; the scutellum showing tawny wine-red; abdomen dark wine-red; mouth and legs blood-red. From Senegal and Egypt.

No. 24. ADENOPLEURA COMPRESSUM (*Macalister*, Quarterly Journal of Micr. Science, n. s. xii. p. 287, pl. xiv. 1872.).—**24.** Enlarged sketch of ditto, copied from Prof. Macalister's figure.



Adenopleura compressum. 1-16th of an inch in length. Copied from Prof. Macalister's figure.

The specimens from which Professor Macalister described this new form of Ixodes were obtained from between the scales of the pangolin of West Africa (Manis multiscutata); it is minute for an Ixodes, being only the sixteenth of an inch in length. It is perhaps with reason, therefore, that Professor Macalister has made a new genus for it.

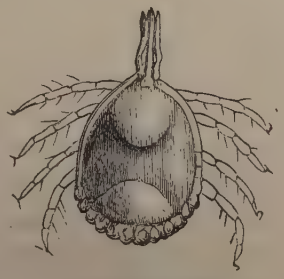
CASE XII.

XIPHIASTOR (*Murr.* n. g.).

Flat, mouth provided with a long projecting rostrum and long palpi applied to it; abdomen with posterior margin beaded.

Nos. 25, 26. XIPHIASTOR ROSTRATUM (*Murr.* n. s.), specimen (1).—**25.** Enlarged sketch of ditto; **26.** Specimen (1).

We received this species from Old Calabar from Mr. C. W. Thomson, formerly one of the missionaries to that coast, whose contributions were the most important of any made to natural science by that mission. Its habits are no doubt similar to those of other species. It is brown, somewhat circular, and with a smooth upper surface. About one-fourth of an inch in length.



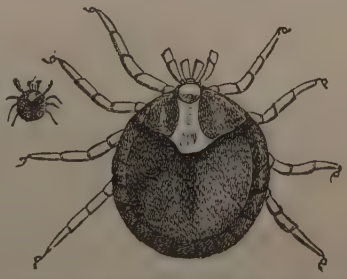
X.phiastor rostratum. From 2 to 3 lines in length.

Genus AMBLYOMMA (*Koch*).

More or less rounded, flat, and with flat, muddy, pale eyes.

Nos. 27, 28. AMBLYOMMA ROTUNDATUM (*Koch*, Arachn.).—**27.** Enlarged figure of ditto; **28.** Specimen (1).

This is a handsome species, nearly flat, with the scutellum, or carapace, whitish speckled with small red and dark spots here and there over its surface, most so on the depressions on each side. Slightly larger than the last.



Amblyomma rotundatum. Magnified and natural size.

This may be taken as the type of a multitude of ticks that infest South America, where they are known by the name of Carapato, being so called in consequence of their resemblance to the Ricinus which bears that name in Portuguese.

CASE XII.

There are many species that go by this name, but no doubt the majority belong to the genus Amblyomma. They are common in all parts of South America where cattle abound; and they not only attack cattle but also horses, dogs, and sheep, and occasionally man himself. Like our own ticks they are found on plants, and when cattle become infested with them it is generally after feeding on open and exposed pastures, where the sun's heat is great; and they increase most in dry seasons.

It is generally, but we may be sure erroneously, supposed that the insect was not seen in the Brazils previously to an excessively hot and dry summer, about 1824 or 25, since which it has multiplied amazingly. It is remarkable that cattle feeding in shady pastures and coppices are frequently quite free from the carapato, but will acquire it by infection from others. The mode in which it appears to cause destruction to the animal infested by it, is by the incessant irritation, which prevents the animal feeding or resting, and in consequence it becomes worn out. Many thousand head of cattle are annually carried off by them, and even a scarcity of food has been caused by them. Prof. Busk, from whom we take some of these details, in describing the young of one species (Trans. Micr. Soc., vol. I.) and the mischief that they do, mentions that "they first appear on those parts of the skin uncovered by hair, and are then not larger than a pin's head, and make the part quite black by their numbers. They adhere so closely, that scraping them off would tear off the skin. In a short time they increase to the size of a bean, or common tick, as seen in dogs, and fix themselves promiscuously on all parts of the hide, where covered with hair.

"The same species appears to insinuate itself in its incipient state, upon the human body, but is not known to assume the tick form there (doubtless because not allowed to remain). They adhere most tenaciously to the skin; and, he says, they are believed to introduce themselves below it, and are very harassing and even create soreness and inflammation. They generally

CASE XII. affect persons who have been passing through woods, although not often seen or found on trees or plants."

Cuvier, after noting that "they are found in thick woods, abounding in brushwood, briars, etc., states that they attach themselves to low plants by the two fore-legs, extending the other feet so as to seize anything that brushes against them, and their claws being provided with caruncles that act as suckers, the slightest touch is sufficient to give them a hold. Besides fastening upon dogs, cows, horses, and other quadrupeds, they even lay hold of the tortoise, burying their suckers so completely in its flesh, that they can hardly be detached by force and by tearing away the portion of skin to which they are fastened. They deposit a prodigious number of eggs."

Prof. Busk incidentally mentions that the specimens that he received of his species came in a letter from Rio Janeiro, which had been sixty or seventy days on the way, and that the insects were still living—a fact more in favour of their being likely to be exposed to long privation before they find a victim, than of their being bred on it with food constantly at their mouth.

Nos. 29, 30. AMBLYOMMA PACIFICUM (*Murr.* n. s.).—**29.** Enlarged figure of ditto; **30.** Specimen (1).

This species came from the Sandwich Islands. It has considerable resemblance to the Carapato of Brazil, but the scutellum has only a small part white (the anterior angles), the rest is reddish brown, the same as the rest of the body. About the same size as the last.

Genus OPHIODES (*Murr.*).

The following species, found on snakes, seem to us sufficiently distinct to warrant their separation into a different genus. Their very thin, flat, circular and somewhat transverse form; their peculiar distribution of colour; and their apparent restriction to snakes, seem to mark them as a distinct and special type.

CASE XII. No. 31. OPHIODES OPHIOPHILUS (*Müll.*, Nov. Act. Nat. Cuv. 1831).—**31.** Enlarged sketch of ditto, copied from Müller's figure.

A species from South Africa which was found upon captive snakes. The colour of its body is pale bluish green like turquoise.

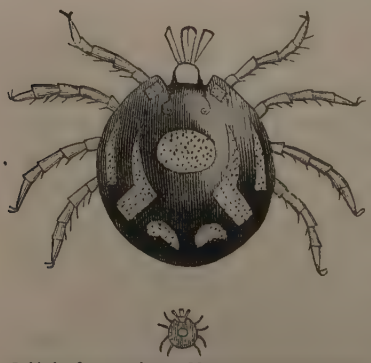
Nos. 32, 33. OPHIODES GERVAISII (*Lucas*, Soc. Ent. Fr. 1847).—**32.** Enlarged sketch of male of ditto; **33.** Ditto of female.

This was found under the scales of the boa constrictor.

No. 34. OPHIODES GRACILENTUS (*Lucas*, Ann. Soc. Ent. Fr. 1846).—**34.** Enlarged sketch of ditto.

This species has also been described by M. Lucas from living specimens taken on the Python Sebæ, on which it fixes itself in the intervals between the ventral scales, which it resembles in colour, its abdomen being yellowish, and head and thorax brownish yellow.

Nos. 35, 36. OPHIODES FLAVOMACULATUS (*Lucas*, Ann. Soc. Ent. Fr. 1846).—**35.** Enlarged sketch of ditto; **36.** Sketch of Python Sebæ on which it was found.



Ophiodes flavomaculatus. Magnified and natural size.

M. Lucas says that this species is very agile, and appears to be rare. He "never met with any but a few individuals that he found living and fixed between the scales of a boa constrictor newly arrived from Senegal." As the boa constrictor is a South American species, and does not occur in Africa, we must read python instead of boa constrictor, for the python is the only large serpent that occurs in West Africa, where it represents the boa.

CASE XIII.

Family HALACARIDÆ (Marine Mites).

We have already spoken of the interest attaching to the occurrence of mites in the sea, and we have seen that one or two that have been found there were only terrestrial species, so constituted, as, like various other insects, to bear temporary submersion without inconvenience. We now come, however, to a group which seems rightly entitled to the name of marine mites. But although we bring them in here, it is not as a transition between the Ixodidæ and Oribatidæ, but rather as a link between the Bdellidæ or Trombidiidæ and Oribatidæ. We can only repeat that there is no linear arrangement in Natural History, and any attempt to make one is constantly interrupted by the necessity of bringing in collateral issues, which the reader must learn to look upon as temporary digressions from the main thread of the story.

These marine mites were first brought under the notice of the scientific world by M. Dujardin in the Journal de l'Institut (1842, p. 316), for we pass over the brief notices of Linnæus and Fabricius, of species living among the sea-weeds on the coasts of Norway, as either not belonging to this group, but more probably to the inter-tidal Gamasidæ of which we have already spoken; or if really belonging to this, then not recognisable from the too vague descriptions unaccompanied by figures. But the species indicated by Dujardin seem really to belong to this group. He speaks first of an Oribates that he found in the sea at L'Orient, and which seems very probably one of those to be presently mentioned, and two other species which he thinks constitute a new genus Molgus near the Bdellidæ, coming the one from the coasts of Bretagne, the other from the Mediterranean, which, as already said, are probably the neckless Scirus described by Dr. Johnston as Acarus longicornis or something allied to it; and lastly, a species that does not swim in the water, and approaches

CASE XIII.

more nearly to the Acari properly so called; doubtless Gamasus marinus, or one of its allies above mentioned.

The next author who noticed them was Mr. Gosse (Ann. and Mag. Nat. Hist. 1855), who described three species, and subsequently Mr. Hodge (Trans. of Tyneside Naturalists' Field Club, iv. and v.) and Mr. G. S. Brady (Proc. Zool. Soc. 1875) have each added one to our list, so that in all we know five species. Both Mr. Hodge and Mr. Brady describe more, but Mr. Hodge's other species seem to be larval forms or varieties of one or other of the known species, and Mr. Brady's come in elsewhere. We speak here only of those we include in this section. We have been induced to make a separate family for them partly on account of the peculiarity of their habitat, and partly on that of their structure, which, notwithstanding that the above authors refer their species to already known terrestrial genera, does not seem to agree with that of any already described family. They refer some of them to the genera Raphignathus and Pachygnathus of the family Trombidiidæ, and others to the family of Oribatidæ, and undoubtedly they have some points of affinity with both; but they also differ from both in important characters, and agree among themselves in others that are peculiar. The chief character given by Dugès for the Trombidiidæ is the appendiculated (or unguiculated finger and thumb) palpus. In only one of the species referred to it by the above authors is this present, and then only in a very modified degree. Another constant character of the Trombidiidæ is the soft pliant silky or velvet-like texture of the skin. The marine species, on the contrary, have either a leathery or a hard skin inclining to crustaceous. In the Trombidiidæ the legs are all set well under the body, and their origin is not near the outer margin. In all the sea mites they proceed from the margin. In this latter respect the Oribatidæ come nearer to these, as also in having a hard outer skin; but the hard outer skin in the Oribatidæ is chitonous like the covering of a beetle, while in the marine mites it is liker that of a crustacean. But

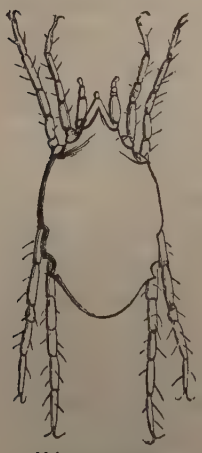
CASE XIII.

independent of that, the Oribatidæ have a very remarkable breathing apparatus, which is either absent in the Halacaridæ, or, if present, has not yet been ascertained to exist. The latter seem to us to have more affinity with the Bdellidæ than with the Trombidiidæ; for most of them (not all) have a projecting snout, and some of them antennæ like palpi, and the Bdellidæ have their legs starting nearer from the margin of the body than the Trombidiidæ, although not from the edge like the marine mites. But, in fact, they have points of resemblance with several families; and, what is curious, characters which, in other families, are of primary importance (as, for instance, the transverse division between the thorax and abdomen), seem here to have lost their value, some having it and some not. Looking at the group altogether, however, we have no hesitation in coming to the conclusion that it belongs neither to the Bdellidæ, the Trombidiidæ, nor Oribatidæ, and still less to any other less similar group. We, therefore, propose to establish a new and distinct family for its reception; and not to hamper it with more characters than we can help, or with any that are difficult to find, we shall define it as mites living habitually under the sea, having either a stiff or a more or less rigid, cuirassed skin, and with their legs springing from the outer margin of the body.

These little creatures have been chiefly obtained by dredging, or from seaweeds in rocky pools of sea water, weeds between tide marks, &c. They have also been observed creeping on the stems of seaweeds or zoophytes, or on the sides of marine aquaria, a mode of obtaining them, which has the great advantage of allowing their form, ways, and habits to be studied while they are alive. Where they do occur, it appears to be in considerable numbers. Mr. Brady remarks, that in some dredgings made off the coast of Durham and Yorkshire, the number of individuals was very considerable, almost leading one to the belief, that they must, in favourable spots, colonize the mud almost as thickly as their better known relatives do a decaying cheese.

CASE XIII.

We do not propose to make any separation of genera, for the species that have been so treated by Mr. Gosse and Mr. Hodge. The extremes, indeed, where on the one hand the insect is entirely enclosed in a hard cuirass, and on the other in a pliant leathery skin, would seem to give good characters for generic sub-division; but there are species that combine these two qualities, being soft-skinned, with patches of head armour, so that, on the whole, as there are only five of them altogether, and the difficulty of making them out is not sufficiently great to call for subdivision, we think it better to keep them as one genus; the more so, that they all have a common facies indicative of belonging to the same type.



Halacarus ctenopus. Length 1-32d of an inch.

Genus HALACARUS (*Gosse*).

Characters same as those of family.

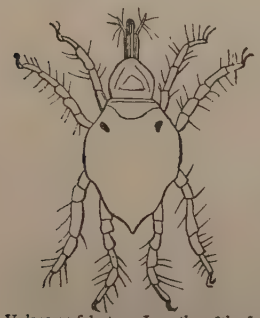
No 1 HALACARUS CTENOPUS (*Gosse*).—1. Magnified sketch of ditto, copied from Mr. Gosse's figure in Ann. Nat. Hist. 1855.

Body, smooth, granulated, divided below only. The colour is variable, usually dark red, or yellowish brown, with a whitish line down the back. Two large eyes, or supposed eyes, on the back near the base of the second pair of legs. Common, and generally distributed around the British coast. Dredged up from seven to thirty-five fathoms.

No. 2 HALACARUS FALCATUS (Leptognathus falcatus, *Hodge*).—2. Magnified sketch of ditto, copied from Mr. Brady's figure in Proc. Zool. Soc.

Colour, orange brown. Palpi very long and slender, extending beyond the tip of the rostrum, and bearing towards the extremities a few fine setæ. Eyes, or supposed eyes, three; one behind the base of the head, the others near the origin of the second pair of legs. Upper surface of the body divided by delicate furrows or striæ

CASE XIII. into four symmetrically arranged areolæ; two lateral, one anterior and one posterior.



Halacarus falcatus. Length 1·28th of an inch. Copied from Brady's figures.

Claw of ditto

Mandibles of ditto.

Dredged off the East and South Coast of England, at from ten to thirty fathoms' depth.

No. 3. HALACARUS SCULPTUS (Pachygnathus sculptus *Brady*).—**3.** Magnified sketch of ditto, copied from Mr. Brady's figure.

Halacarus sculptus, upper side. Length 1·45th of an inch. Copied from Brady's figures.

Mandibles and palpi of ditto.

Ditto, side view.

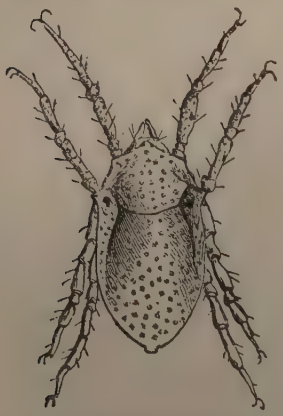
Colour, reddish brown. Palpi consisting each of a short, slightly curved stem, which is furnished with two small setæ and a wart-

CASE XIII. like tooth on the concave margin. The dorsal surface of the body is mapped out into distinct areas, characterised by pitted and corrugated systems of sculpture, which extends to the second, third, and fourth joints of the legs. Eyes not observed.

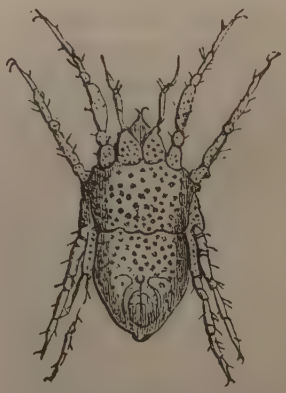
Dredged from various localities off the coast of Durham and North Yorkshire, in twenty-five to thirty-five fathoms.

No 4. HALACARUS RHODOSTIGMA (*Gosse*), (Halacarus granulatus, *Hodge;* Halacarus oculatus, *Hodge*).—**4.** Magnified sketch of ditto, copied from Mr. Gosse's figure.

Colour, pellucid whitish, stained with pale red on the anterior half. Palpi of four joints, the terminal one slightly curved. Body



Halacarus rhodostigma, upper side. Length 1/72nd of an inch. Copied from Gosse's figure.



Halacarus rhodostigma, under side.

divided above and below, and studded with punctures, which under a high power take the form of rosettes, or the spots on a panther's coat. Nothing is said as to the eyes, but two large spots are figured on the back, near the origin of the second pair of legs.

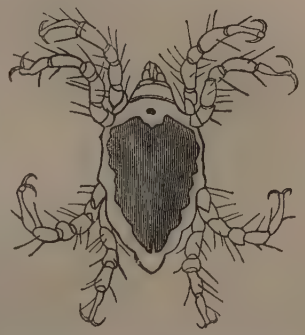
Not uncommon, found by dredging, and among seaweeds at low water, on the sea coast at Weymouth, Durham, Northumber-

CASE XIII. land, York, and Firth of Clyde, and, therefore, probably all round England and Scotland.

No. 5. HALACARUS NOTOPS (*Gosse*) (Pachygnathus notops, *Gosse;* Pachygnathus seahami, *Hodge;* and Pachygnathus minutus, *Hodge*, larval form).—**5.** Magnified sketch of ditto, copied from Gosse's figure.

The body is flat, lozenge-shaped, hyaline and colourless at the margins, but the interior is almost filled with flesh of a deep blue-black hue, perfectly opaque, and of a defined sinuous outline. In the centre of the back, just behind the head, is a bright ruby-like round eye placed in front of the opacity and between the first legs.

Taken by Mr. Gosse, at Ilfracombe, and by Mr. Norman abundantly on weeds in rock pools, Balla Sound, Shetland.



Halacarus notops. Copied from Gosse's figure.

The reader may have observed, that in speaking of those eyes on the back of some of the preceding species, near the origin of the second pair of legs, we have called them eyes or supposed eyes; we did so, because we remembered that in the Oribatidæ (the next section of mites), there is an organ placed very much in the same position, which for long was supposed to be their eyes, but which, when its true nature was ascertained, turned out to be not eyes, but breathing pores. We do not say that it is so in the Halacaridæ, but as it may be so, we thought it as well to qualify the term with a point of doubt.

Family ORIBATIDÆ, or BEETLE MITES.

The Oribatidæ are mites which have a hard chitonous integument like that of a beetle, and they are generally brown or black, globular, and shining. In their young state, some of them (Hoplo-

CASE XIII.

phora) have been ascertained to have a similar structure to that of the young of the family to which the cheese mites belong (Acaridæ). They differ, however, in having no vesicle attached to their feet, but they correspond with a portion of them, in having a remarkable breathing apparatus, consisting of two tubes, which open on the back part of the thorax, adding another to the different variations in the mode of breathing in insects. This may be seen in the accompanying woodcut of the cephalothorax of one of them (Damæus auritus). They are also furnished with curious appendages, such as plates or lamellæ, and differently formed hairs and tubercles on different parts of the body. They have no eyes. As already said, for a long time the two singular breathing apertures near the posterior angles of the cephalothorax, were supposed to be eyes, but now that the function of sight has been found not to belong to them, nothing else of the nature of eyes has been discovered in their place. They have tarsi bearing one, two, or three claws, according to the species, but no suckers in any.

Head of Damaeus auritus, showing breathing pores and lateral projections. Copied from Nicolet.

Their development has been traced in many species from the egg. The young larvæ are hexapod when hatched.

Authorities are not at one as to whether these insects should be classified as hurtful or not. M. Nicolet, who has monographed the Oribatidæ found in the neighbourhood of Paris, says that they never cause any damage either to man or the products of his industry, but Mr. Curtis classes at least one of them as hurtful to fruit trees. In one respect, in which he differs from Nicolet, he certainly is right. Nicolet says that they are essentially vagabond and solitary, inhabiting the moist mosses in forests and the sheltered banks of waters, that they are found sometimes under stones resting on a humid soil, and in decomposing vegetable matters, but that

CASE XIII. the shelter of mosses is what they prefer, and it is there that they are found in greatest number.

According to Curtis again, whose statement we can confirm from personal observation, at all events the commonest and most typical species of them, Damæus geniculatus, is found chiefly under bark, and specially under the bark of fruit trees, and, instead of being solitary and vagabond, it is gregarious, and congregates in the spring in great numbers at the base of the twigs, so much so, as to look like a gummy exudation. Mr. Curtis, in consequence of their prodigious numbers, thinks that by extracting the sap they must weaken the trees, and in all probability reduce the size of the fruit. But M. Boisduval has been able to show authoritatively that this idea is erroneous. He says:—

"In 1858, M. Rivière brought here a great number of individuals of the Oribates geniculata (the black stone tick of Geoffrey), which had multiplied in a prodigious manner in the hothouse of the old garden of the School of Medicine, to such a degree that several orchids were covered by them. This clever observer was rather alarmed at the sudden apparition of all these ticks on a family of plants which he particularly affected; but he was soon re-assured when he saw that not a single leaf had suffered the slightest alteration, and that these little animals were hunting acarus, thrips, etc., of which they were eating the eggs and larvae. At the end of some months all had disappeared. From whence came this legion of Oribates? He thinks that the eggs, or individuals recently hatched, had been brought in the moss and sphagnum of which horticulturists make use for the culture of exotic orchids, and that the development had taken place in the panniers and baskets containing these plants. The horticulturist is therefore to regard them as friends and not as enemies.

The more important characters used in subdividing the species of this group, are drawn from the number of claws to the tarsi, and certain peculiar plates or expansions, which are borne by

CASE XIII.

the cepnalothorax and abdomen. These, however, only serve the purpose of an artificial arrangement, and we have disregarded them in our attempt at a more natural classification; but for the benefit of those who wish a little help in making them out without referring to Nicolet, we here give the heads of his arrangement:—

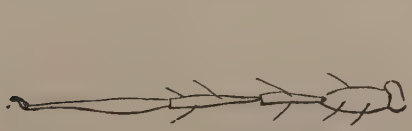
1st Section.—Tarsi with three claws.
Subsect. 1.—Cephalothorax with lamellar appendages.
A. With lateral wing-formed movable expansions to the abdomen, and with heterodactyl tarsi, that is, with the middle claw larger than the two others.
a. Hairs on the vertex, spatula-shaped. 1. *Pelops.*
b. Ditto, ditto, bristle-shaped. 2. *Oribata.*
B. Without lateral wing-shaped expansions.
a. Tarsi homodactyl, *i.e.* claws alike.
α. Tectum attached to the cephalothorax only by its base. 3. *Cepheus.*
β. Tectum confounded with the cephalothorax. 4. *Notaspis.*
b. Tarsi heterodactyl. 5. *Leiosoma.*
Subsect. 2.—Cephalothorax without lamellar appendages.
A. Legs slender, with flexible hairs and fusiform joints, terminated by a heterodactyl tarsus. 6. *Eremæus.*
B. Legs thick, with rigid hairs, and subcylindric joints, terminated by a homodactyl tarsus. 7. *Nothrus.*
2nd Section.—Tarsi one-clawed.
Subsect. 1.—Cephalothorax with salient apophyses, or nervures (ribs).
A. Legs longer than the body. 8. *Damæus.*
B. Legs shorter than the body. 9. *Tegeocranus.*
Subsect. 2.—Cephalothorax, without apophyses.
A. Cephalothorax, soldered to the abdomen, and immovable. 10. *Hermannia.*
B. Ditto, articulated on the abdomen, and movable. 11. *Hoplophora.*

Although few of the species of the family of Oribatidæ have been recorded as found in England, we have figured and noted the chief genera, believing that if they are properly sought for, the species commonest in France will also be found in Britain. Species of at least four of the genera have been met with in Spitzbergen, so the coldness of the climate should be no obstacle to their living here.

CASE XIII.

Genus DAMÆUS (*Koch*).

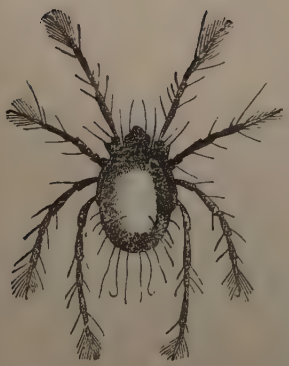
This genus has only one claw, as shown in the woodcuts, and has ribs on the cephalothorax, as shown in the cut of the head of Damæus auritus, on page 212.



Damaeus auritus, leg of. Copied from Nicolet.

Claw of ditto. Copied from Nicolet.

Nos. 6, 7, 8. DAMÆUS GENICULATUS (*Koch*), (Acarus corticalis, *De Geer*).—**6.** Magnified sketch of embryo fresh from the egg of ditto; **7.** Magnified sketch of larva; **8.** Magnified sketch of perfect insect; all copied from Nicolet's figures.



Newly hatched larva of Damaeus geniculatus Copied from Nicolet.

Damaeus geniculatus, size of a pin's head. Copied from Nicolet.

The young differ very much in appearance from the mature

CASE XIII.

individuals in most of the Oribatidæ, and M. Nicolet traced the changes in a number of them. We show the difference in the present species in the above cut.

This species is found from November to March, beneath the slightly detached bark of fruit trees, such as the pear, where they live in society, remaining very quiet during the winter months; they also secrete themselves and breed under the lichen, which often covers the trunks and branches of fruit trees. Various remedies have been recommended for getting rid of this mite, but as it is a friend to be encouraged, and not an enemy to be repressed, it is unnecessary to detail them.

M. Boisduval, in his "Entomolgie Horticole," speaks of an Acarid, which he calls Acarus Pyri, as being relatively very large, globular, vesicular, of a red brown, rather transparent, very visible to the naked eye. It, says he, lives on the large branches of the pear-trees which have been gnawed inside by the Leopard moth; they are usually found in small crowded groups at the bifurcation of the branches. It may possibly be an Oribatid, although it is not likely that it could be this species, with which M. Boisduval, was obviously familiar.

No. 9. DAMÆUS AURITUS (*Nic.*).—**9.** Magnified sketch of ditto, copied from M. Nicolet's figure.

This species is as common as the preceding species in France, and very probably may also be found in this country, although probably hitherto confounded with the D. geniculatus.

Genus LEIOSOMA (*Koch*).

Cephalothorax with plates, and tarsi with three heterodactyl claws.

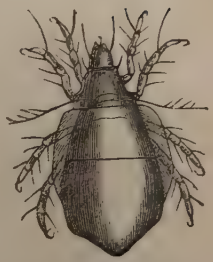
No. 10. LEIOSOMA NITENS (*Gerv.*).—**10.** Magnified sketch of ditto, copied from Nicolet's figure.

Occurs near Paris.

CASE XIII. LEISOMA OVATA (*Nicol.*).

The larva differs materially from the perfect insect, which is very similar to an Oribata.

Near Paris.



Larva of Leiosoma ovata
Copied from Nicolet's figure.

Genus NOTASPIS (*Hermann*).

Cephalothorax with lamellar appendages, tarsi with three homodactyl claws.

No. 11. NOTASPIS BIPILIS (*Herm.*).—11. Magnified sketch of ditto, copied from Nicolet's figure.

Notaspis bipilis. 0m·00067 in length. Copied from Nicolet.

Very common in France.

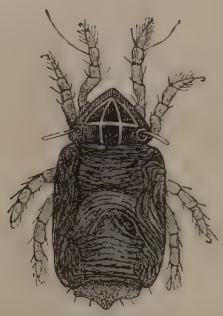
Genus ORIBATA (*Latr.*).

Cephalothorax, with lamellar appendages; tarsi with three heterodactyl claws; hairs on vertex bristle-shaped.

No. 12. ORIBATA ORBICULARIS *Koch*).—12. Magnified sketch of ditto, copied from Nicolet's figure.

Common near Paris.

CASE XIII.



Larva of Oribata punctata. Copied from Nicolet.

ORIBATA PUNCTATA (*Nicolet*); O. ovalis (*Koch*).

The difference between the young and the perfect insect of Oribata will be seen by comparing the figure of the larva of this species with that of the perfect insect of the next.

Common near Paris.

No. 13. ORIBATA GLOBULA (*Nicol.*).—**13.** Magnified sketch of ditto, copied from Nicolet's figure.

Oribata globula. 0.00010 in length. Copied from Nicolet.

Mandible of ditto. Copied from Nicolet.

Found near Paris.

ORIBATA NOTATA (*Thorell*), Oëfv. Sv. Ak. xxviii. 695 (1871).

A new species found in Spitzbergen.

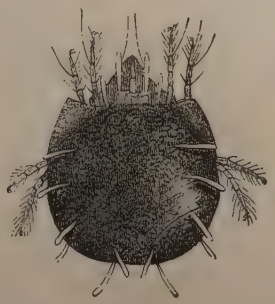
Genus PELOPS (*Koch*).

Differs from Oribata in the hairs on the vertex being flat or spatula-shaped.

CASE XIII. Nos. 14, 15.

PELOPS ACROMIOS (*Herm.*).—**14.** Magnified sketch of larval form of ditto; **15.** Sketch of perfect insect. Both copied from Nicolet's figures.

Larva of Pelops acromios. Copied from Nicolet.



Pelops acromios. 0m.00060 in length. Copied from Nicolet.

Leg and claw of ditto. Copied from Nicolet.

Found by M. Nicolet near Versailles.

Genus NOTHRUS (*Koch*).

Cephalothorax, without lamellar appendages. Tarsi with three homodactyl claws.

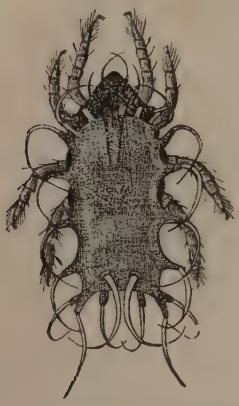
Nos. 16, 17.

NOTHRUS SPINIGER (*Koch*).—**16.** Magnified sketch of larval form of ditto. **17.** Ditto of perfect insect. Both copied from Nicolet's figures.

The genus Nothrus is one of the most curious of this family. It is a heavy, slow, quadrangular creature, irregular in shape, with the back oftener concave than convex, a peculiarity of which it profits by using it as a sort of basket to contain or carry a pile of dirt, with which it fills or covers it. The abdomen has expansions or spines which are used for the same purpose. Eminently tardigrades, says M. Nicolet, these Acarids move with the most extreme slowness, they raise their legs with difficulty, and their

CASE XIII.

heavy body, rendered still more unseemly by the filth with which they cover themselves, upsets them at every step they take when they walk on a flat surface. Their larvæ are like the perfect insect. only softer and whiter, and they are always covered by a layer of soil or dirt, pellets of which they appear to be to the onlooker. The tarsi are monodactylous in the larva, tridactylous in the perfect insect. The present species is of a violet brown colour, like the lees of wine. It is common everywhere near Paris, but is difficult to detect on account of its earthy covering, which, moreover, it is difficult to remove from its back, on account of its lateral spines being interlaced and mixed up with it.



Larva of Nothrus spiniger. 0m.00080 in length. Copied from Nicolet.

Claw of Nothrus spiniger. Copied from Nicolet's figure.

No. 18. NOTHRUS HORRIDUS (*Herm.*).—**18**. Magnified sketch of perfect insect, copied from M. Nicolet's figure.

Nothrus horridus, covered with its cloak of dirt. Copied from Hermann's figure.

Nothrus horridus, 0m.00112 in length. Copied from Nicolet.

CASE XIII. Another very curious species like the preceding. It also is a very common species in the neighbourhood of Paris. We are not aware that these have yet been found in Britain—but they are worth looking for on account of their remarkable structure and habits. This one is especially found in damp moss—and no doubt the covering of dirt on its back is designed as a protection from too much dryness or heat. A species has been described by Thorell from Spitzbergen, under the name of Nothrus borealis.

Genus HERMANNIA (*Nicolet*).

Cephalothorax without ribs, soldered to the abdomen; tarsi with one claw.

Nos. 19, 20. HERMANNIA CRASSIPES (*Nic.*).—**19.** Magnified sketch of larva; **20.** Ditto of perfect insect. Both copied from M. Nicolet's figures.

Larva of Hermannia crassipes. Copied from Nicolet's figure.

Hermannia crassipes, 0m.00080 in length. Copied from Nicolet's figure.

Another curious, heavy, lumpy insect common in the neighbourhood of Paris. It is distinguished by rows of flat spatula-shaped hairs on its body and legs. It also affects mosses.

This genus also is represented in Spitzbergen, a species named H. reticulata having been described by Thorell.

Genus CEPHEUS (*Koch*).

Same character as Notaspis, but the tectum attached to the cephalothorax only by its base.

CASE XIII. No. 21. CEPHEUS VULGARIS (*Nic.*).—**21.** Magnified sketch of ditto, copied from M. Nicolet's figure.

Very common everywhere near Paris.

Genus EREMÆUS (*Koch*).

Cephalothorax simple, without lamellar appendages; tarsi with three claws, heterodactyl.

No. 22. EREMÆUS TIBIALIS (*Nic.*).—**22.** Magnified sketch of larval form of ditto, after Nicolet's figure.

The species of this genus are rare, but are interesting from the form of the larva, from their having concave backs like Nothrus, and from their general resemblance to Hoplophora.

A species (E. lineatus, *Thorell*) has been found in Spitzbergen.

Larva of Eremaeu tibialis.
Copied from Nicolet's figure.

Eremaeus tibialis.
Copied from Nicolet's figure.

Genus HOPLOPHORA (*Koch*).

Cephalothorax articulated to the abdomen, and folding upon the body; tarsi monodactyl.

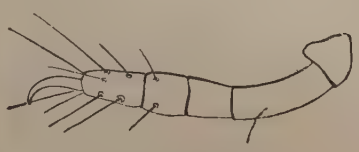
Nos. 23, 24, 25. HOPLOPHORA CONTRACTILIS (*Clap.*), (Hoplophora nitens, *Nic.*; Phthiracarus contractilis, *Pertz.*).—**23.** Magnified sketch of nymph; **24.** Ditto perfect

CASE XIII.

insect not shut up; 25. Ditto contracted. All copied from figures by Claparède, in Zeitsch. für Wiss. Zool. xviii.

Hoplophora contractilis, perfec. insect, not shut up.

Ditto, shut up. Copied from Claparède.



Claw of ditto. Copied from Claparède.

M. Claparède of Geneva, not long before his death, made a series of studies of the Acaridæ, one result of which was to reveal an affinity between the Oribatidæ and the Acarids proper (cheese mite tribe), which, if suspected, had, at all events, not been previously established. The older writers, Gervais for example, instinctively, perhaps, felt that it was so, and so arranged them; but in the most recent handbooks (such as those of Gerstaecker and Claus), the Gamasidæ and Ixodidæ are placed between the Oribatidæ and the Acarids proper, but Claparède has given good reasons for regarding this as an unnatural arrangement. The arrangement of Gervais was better. He placed the Acarids next the Ixodidæ, and the Oribatidæ last; but we wish to close the arrangement of the mites with the parasitic Sarcoptidæ as a passage to the lice, and therefore place the Oribatidæ before the Acarids instead of after them, it being indifferent so far as any other affinity is concerned, where we place them. The present species was the medium which led Claparède to these conclusions. It lives in moist and decaying fir wood, burrowing in and feeding on the wood, the burrows for the most part running parallel with the vessels of the wood, but also occasionally running into one another. Its habits thus give some facility for observation. A morsel of wood inhabited by them could be put in a glass tube and kept at the proper degree of moisture, while their development is being watched. The perfect mite is very minute, clothed with a thick, hard, rigid, brown coat of mail, and with a curious power of

CASE XIII.

bending the head down upon the under side, so that when it chooses it can, like some beetles, retire entirely into its shell and shut it up, looking then like a tiny, oval, brown speck, without head, legs, or any other members visible. Claparède found this little creature in the burrows or borings in rotten fir wood; but he also sometimes found in them, but rarely together, another larger, semi-transparent, soft, white mite, like a cheese mite. The idea which would naturally occur to anyone would be that this might be the larva; but then it had eight legs, and therefore it was assumed must be a perfect insect; and, moreover, by watching the hatching of the eggs deposited by the Hoplophora, Claparède soon ascertained that, as usual, the first stage was a six-footed soft white mite, bearing a close resemblance to the eight-footed, soft, white Acaroid form. What relation did the latter bear, then, to the Hoplophora with which it was associated? M. Claparède solved this by the following experiment: He took twenty specimens of the soft white Acaroid mite, and placed them upon a morsel of decaying pine wood, first taking care to see that there were no other mites present. He then put the wood in a moist flask, which he allowed to remain undisturbed for three weeks. After that time he took the wood out of the flask. The mites were scarcely to be seen. They had penetrated by boring, and he had to dig them out. On examination he found only twelve specimens resembling Acarus against seven Hoplophora. A transformation of seven had thus taken place, and one individual was missing. However, the nature of the transformation was not yet clear. He repeated the experiment in which he, at the same time, included a larger number of specimens. So he followed the traces of the transformation. His researches into the development of Hypopus, of which we shall presently have to speak, suggested to him that as its colourless Tyroglyphus-like larva enclosed a brown Hypopus on its way, as

Hoplophora contractilis (larva). Copied from Claparède's figure.

CASE XIII. he thought, to complete development, so in the same way he might find here the brown Hoplophora in the Acarus-like larva. But he found that from the pale-coloured larva a perfect colourless Hoplophorus proceeded, within which the intestinal canal retained the same milk-white appearance as in the larval condition. Those which were becoming Hoplophora appeared very light to the eye. The perfect soft animal leaves in this condition the larval skin. All peculiarities of the Hoplophora are visible. The parts are, however, peculiarly tender. The insect lies for a long time seemingly immovable. By degrees the coat thickens, which also becomes firm; in which it still remains colourless. At first it becomes pale rose colour, then reddish, and at last quite brown.

The question was thus set at rest. The Acarus-like form and the Hoplophora stand in a genetic relation to one another, and the Hoplophora proceed from the already eight-footed Acarus, showing that that cannot be regarded as an adult mature state. A very important point remained doubtful, however. In all his experiments several Acari, and these the largest specimens, did not change. How are these individuals to be looked upon? Perhaps as males. It is very striking that he did not find in the Hoplophora any difference of sex, and that the plurality of individuals contained eggs. Nor could he with any certainty discover anything distinctive of the male sex. The important fact ascertained by M. Claparède is, that the Hoplophora goes through an Acarus-like, soft stage, which proves its relationship to the real Acarids (cheese mites, &c.).

HOPLOPHORA ARCTATA (*Riley*, 6th Missouri Report).

Hoplophora arctata. Copied from Riley's figures.

CASE XIII.

We have found this species in England about the roots of the vine, along with Phylloxeræ, Hypopi, and Gamasidæ.

Mr. Riley found this curious species in America associated with a Tyroglyphus which he found in the perfect state feeding on the Phylloxera vastatrix at the roots of the grape-vine, and he supposed it possible that it might in some way be related to these Tyroglyphi, because in studying their habits he had frequently filled vessels with vine roots from which all but Tyroglyphi and Phylloxeræ had, to all appearance, been carefully excluded, only to find, on subsequent examination, a number of these mussel-like Hoplophoras, and a corresponding decrease in the number of Tyroglyphi. It is not unlikely, however, that he is in error in this. Our woodcut of the larva of Hoplophora shows how similar they are to the larvæ of the Tyroglyphs, and how easy it would be, in sweeping in a number of Tyroglyphs of all ages, unwittingly to include some of the larvæ of Hoplophora among them. Mr. Riley, however, remarks that from his results happening in the fall of the year, he could not help suspecting that the former might prove to be a hibernating form of the latter; but with wise discretion he has preferred to explain the facts by supposing that at first the Hoplophora were buried, and consequently invisible within the roots examined, and that the decrease in the number of Tyroglyphs was owing to death and other causes—an explanation which (says he) is all the more plausible from the fact that he subsequently found the same narrow-bodied Hoplophora swarming in decaying cotton wood logs—an explanation, however, which does not meet the circumstance he mentions, that the new Hoplophoræ corresponded in number to the missing Tyroglyphs, although it might be sufficient had no such correspondence been observed.

The present species differs from the other members of the genus in the form of its chitonous coat, which is so narrow that the animal topples over on its side the moment the limbs are withdrawn.

ECONOMIC ENTOMOLOGY.

BY

ANDREW MURRAY, F.L.S.

APTERA.

DIVISION III.—*CHEESE MITES, ITCH MITES, LOUSE MITES, GALL MITES, LICE, AND SPRINGTAILS.*

Prepared at the request of the Lords of the Committee of Council on Education, and published for them

BY

CHAPMAN AND HALL, 193, PICCADILLY.

CASE XIV.

Family ACARIDÆ.

Authors have hitherto been in the habit of including in one division, called Sarcoptidæ, the whole of the old genus Acarus, or soft-bodied semi-transparent fleshy mites. By far the larger portion of these seems to us, however, to be capable of division into two tolerably distinct and easily distinguishable sections. One, the cheese mites and their allies (Tyroglyphidæ), and the other the Sarcoptidæ, Itch mites, and their relatives the louse mites. This, however, does not exhaust the list of those usually ranked under the Sarcoptidæ. There are at least three minor groups, the Hypoderidæ, the Hypopidæ, and the Phytoptidæ, which are all so peculiar in their appearance and mode of life, that we propose to rank them as separate secondary sub-divisions. We would suggest as a convenient arrangement that the whole of the old genus Acarus should be divided into the following sub-families—viz. :

1st SECTION.—Surface of skin smooth, shining or velvety; tarsi usually with claws.

1. Hypoderidæ.—Long bodies and very short legs, with a great distance between the two anterior and two posterior pairs; parasitic under the skin of birds; mouth not made out.
2. Hypopidæ.—Without any apparent mouth; anterior pair of legs generally much developed; posterior often almost atrophied.
3. Tyroglyphidæ.—Cheese mites, with chelate mandibles and stout legs, and the tarsi in some with and others without a sucker.

2nd SECTION.—Surface of skin more or less transversely striated; tarsi usually with suckers instead of claws.

4. Sarcoptidæ.—Itch mites, which are rounded or quadrate, with legs short and feeble; and Dermaleichidæ.—Louse mites, usually elongate, and often with some of the legs monstrously developed.
5. Phytoptidæ.—Gall and bud mites.

We know that no definition can be given which will absolutely and sharply separate any group of insects, but the above characters will, we think, answer the purpose of a natural arrangement, provided a few transitional exceptions on either side be allowed. The species of the first group, Hypoderidæ, are internal parasites; the next group, Hypopidæ (as we believe), are Ichneumon para-

CASE XIV.

sites; the third, Tyroglyphidæ, not parasitic; the fourth, Sarcoptidæ, are burrowers in or parasitic on the skin of mammals; the Dermaleichidæ are feeders on fur and feathers of living animals; and the Phytoptidæ browsers on the skin of buds and leaves, producing excrescences like galls on the latter. With scarcely an exception, all of the first section have a smooth skin not marked by minute striæ, lines or wrinkles. Of the second, on the other hand, all have the skin marked by fine striæ or lines like wrinkles, the lines being distributed after a definite pattern, differing in each species. In the former the legs are usually terminated by a single claw, more or less distinct, and although in many species this is accompanied by a sucker or vesicle, it is usually small, and generally surrounds the claw, like a sleeve; while in the latter the suckers, with rare exceptions, are present as a prominent feature, while claws are either absent or only slightly developed.

Sub-Family HYPODERIDÆ.

Parasitic sub-cutaneous mites living between the skin and the muscle of certain birds. They are oblong oval, almost transparent bags, with the two anterior and two posterior pairs of legs placed a long way from each other; the claws of the tarsi seem to be two fine hairs, and we do not think that the parts of the mouth have been deciphered.

Montague seems to have been the first to notice these creatures; at least, the species named by him Cellularia bassani, which lives in the air cells under the skin of the solan goose (Sula bassana), must have been one of this genus. Nitzsch next observed the same species, which he named Sarcoptes subcutaneus. Then, in 1843, Miescher described two found in the common swift (Cypselus apus), one in the bronchial tubes, (which, notwithstanding that Erichson, from the description, thinks must have been a Dermaleichus, from the habitat most probably belongs to this group), and another from the air tubes and lungs of the Butcher-bird (Lanius Excubitor) in immense quantity.

CASE XIV. That author had also formerly observed, on the inner surface of the skin taken off a common mouse, small milk-white knots of about the size of a pin's head, which, under the microscope turned out to be nests of mites, containing 20 or 30 small mites. He also met with flat angular mites many times larger, under the skin of a fox. Whether both or either of these belong to this genus there are not sufficient materials to determine—nor, indeed, have we met with any carefully described and figured record of the presence of the genus Hypoderas anywhere but under the skin of various species of birds.

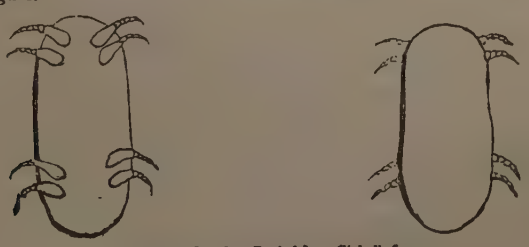
There is no doubt, however, as to a species described by Dr. Gros, in a paper in the "Bulletin of the Imperial Society of Moscow" (1845, s. 397, tab. 11), which he found under the skin and even in the muscles of a heathcock. Thereafter, in 1864, V. Frauenfeld described a species (Hypoderas unicolor) that was found in great numbers massed together in a ball forming a subcutaneous tumour under the wings of a grosbeak (Verh. Zool. Bot. Gesell. in Wien, XIV., 385).

Since then a considerable number of species have been described and figured by Giebel in the "Zeitschr. Gesamm. Naturw. III.," from which we have taken the illustrations of this group.

Genus HYPODERAS (*Frauenfeld*), Cellularia, *Montague.*

Characters same as those of the sub-family.

No. 1. HYPODERAS BREVIS (*Gieb.*).—1. Magnified sketch of ditto from Giebel's figure.



Hypoderas brevis. Copied from Giebel's figure.

CASE XIV.

Found in the cellular tissue of the Night Heron (Ardea nycticorax), a bird very common in many countries of Europe, in Africa, and also in Asia and Japan.

Hypoderas lineatus. Copied from Giebel's figure.

No. 2.

HYPODERAS LINEATUS (*Nitzsch*).—**2.** Magnified sketch of ditto from Giebel's figure.

Nitzsch found this species in inconceivable numbers in an old night heron (Ardea nycticorax) in various places, but especially in the fatty masses which lie in the arm-pit on the outer margin of the pectoral muscle. They were in abundance in the cellular tissue, and there was no perceptible opening communicating with the exterior.

Cellularia columbæ (under side). Copied from Robertson's figure.

Ditto, on vein of pigeon. Nearly natural size.

HYPODERAS COLUMBÆ, Cellularia sp. (*Robertson*, Journ. Micr. Soc. N. S. vi. 201).

Mr. C. Robertson has described and figured a species without name, but to which we have provisionally given the name of Columbæ, after the animal in which it was found. It is obviously a species of this genus, and as Mr. Robertson points out it is very near the species above-mentioned, described by Montague under the name of Cellularia bassani, from the Solan goose. By the rules of priority Cellularia should therefore take precedence of Frauenfeld's modern name Hypoderas; but the former name has for long been appropriated to a genus of Polyps, and the present is a type of too abnormal a nature to allow a double employment of the name to be admitted.

CASE XIV. Mr. Robertson reports of his species that it is a small maggot-like animal, distinctly visible to the naked eye, and that it was found chiefly amongst the connective tissue of the skin, on the large veins near the heart, and on the surface of the pericardium. When few were observed, these were generally found adhering closely to the large veins near the heart. If the veins have been previously injected with size and vermilion, the white transparent acari are seen very distinctly on the red delicate walls. All the examples which he examined were very transparent, without any trace of well-defined digestive or generative organs, even when examined with the highest powers. He adds that he had examined a considerable number of both the wood and tame pigeon and seldom found them free from these or similar Acari.

Sub-family HYPOPIDÆ.

The characters of the sub-family are the same as those of the genus, for although it contains two or three different forms, which probably may hereafter be resolvable into separate genera, we have not as yet thought it necessary to introduce these.

Genus HYPOPUS (*Dugès*).

Until recently the study of this genus was attended with no particular interest beyond that attaching to its fellow mites; but in 1868, an element of doubt and uncertainty was introduced by M. Claparède, who announced, as the result of his researches ("Studien an Acariden"), that the genus hitherto known as Hypopus was only a male form of certain Tyroglyphidæ evolved out of the larvæ in the same way that we have seen the perfect Hoplophora appear. To enable the reader to understand the position of this curious question, we must give him a short history of the observations on Hypopus.

In August, 1735, De Geer observed great numbers of very little mites on the house-fly. They were in such large numbers, that the neck and back were entirely covered with them. They were

CASE XIV. perfectly still, but when touched, began to run with much quickness. Their colour was reddish; the body oval, and the head furnished with a little trumpet, in front of which were several rather long hairs. The first two pairs of legs were large, the third much shorter, and the posterior very long and filiform. Linnæus, after this author, described it in his "Systema Naturæ," under the name of Acarus muscarum: Geoffrey, who seems also to have seen it, called it the brown Fly-mite. This was the first notice we have of the Hypopus.

Subsequently, in April, 1797, Hermann found in great numbers, on the underside and feet of a larva of a Lamellicorn beetle (Osmoderma eremita), very small, oval, fleshy mites, of a brownish yellow, with short stiff feet, and the tarsus with prickles bent outwards, which he called spinitarsus (Acarus spinitarsus).

Dugès, long afterwards (in 1834), found on a Hister an Acarus, which he thought was identical with that of Hermann, and made a genus (Hypopus) for it, to which he transferred the Acarus muscarum of De Geer, and which he thus characterised in placing it in his family of Acarus. "These Acarids have a narrow sucker, provided with two rigid bristles, directed outwards, and seeming to be composed of a lip soldered to the palpi." He adds, that the mandibles were not seen by him. By the crushing of the only specimen he had in his hands, he saw that the anterior bristles started from a moveable part, in the form of a parallelogram, membranous in the middle, and thick at the edge, like the lip soldered to the palpi in the Acarids, properly so called. He could find no other palpi, nor perceive the mandibles.

Leon Dufour, in 1839, discovered two other species of this genus; the one (H. feroniarum), lived in crowded groups under the head, corslet, and abdomen of beetles belonging to the genus Feronia; the other (H. sapromyzarum), lived on diptera of the genus Sapromyza.

Thereafter, Dujardin, in 1843, described an Acarus, which from the mouth and abdominal suckers, cups, or sucking appa-

CASE XIV.

ratus, he called Ancetus, from the Greek word meaning incomprehensible. He found a number of individuals upon the underwing of a bee. All that he saw of its organisation, its haunches drawn near each other, and contiguous to the median line, and occupying more than two-thirds of the whole length, the head rudimentary or null, and replaced by a short blade, with two bristles in front, but without any trace of mouth, its feet quite unfit for walking, and the four posterior ones almost rudimentary; finally, the ten or twelve sucker-cups on the underside of the abdomen, behind the haunches, prevented his suspecting the slightest analogy with that which has been so imperfectly described, and figured under the name of Hypopus.

M. Gervais, in 1844, in the Apteres ("Suites à Buffon"), looked upon Hypopus as a sub-genus of Tyroglyphus, and characterised it by the ellipsoïd, flat, coriaceous body, the absence of palpi, by an oblong lip, short feet, without claws, terminated by vesicular caruncle. But M. Dujardin says, this last character is opposed to what Dugès saw of the feet of his Hypopus spinitarsus, neither does the flattened form agree with the former species, as Hermann had already described.

Koch, in his great work on the Arachnidæ of Germany ("Deutschland's Crustaceen"), had taken no account of the genus Hypopus; but later, in 1843, in his "Ubersicht," he takes up the genus, and places in it two other species, which he had formerly included under Uropoda.

That was the state of affairs when M. Dujardin, who had made a profound study of the subject, satisfied himself that his Ancetus was only a Hypopus. He found, like De Geer, the Acarus muscarum on flies, and in such abundance on the abdomen and thorax, that these parts seemed clothed as if with a granular tissue. All these Hypopi hold themselves there immovable, fixed indifferently on different parts of the skin of the animal by the suckers on the after-part of the abdomen, which seem to have no purpose but to fix them solidly, and being placed posteriorly

CASE XIV.

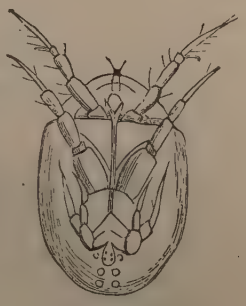
on the underside, make them all take the same position, slightly inclined, with their anterior feet in the air. If they are touched, they set a-running; but in place of finding these mites on the house-fly, as De Geer had done, it was exclusively on the stable-fly, Musca stabulans, that Dujardin found them in Paris, in 1846 or 1847, in a neighbourhood where there were many stables. That fly appeared infested by the Hypopus in such numbers, that out of three, it was rare that two or more were not found charged with them, while the house-fly, and several other species of flies, and of Anthomyia, which were quite as abundant, never furnished him with a single individual. In the species on that fly the four anterior feet are disproportionately robust, and terminated by a single strong claw; the legs of the third pair are couched in a forward direction, under the margin of the body, which conceals them entirely, and those of the last pair terminate in a long hair, instead of a claw; but in other species all eight legs have a claw. The haunches are contiguous, and usually form a thick median line, but the most extraordinary part of the whole is the head, which is produced into a flat and narrow blade, cut square at the extremity, and from the angles of which proceed two diverging bristles or hairs, but without any trace of mouth or even rudimentary oral organs. Still, although no trace of opening can be seen in this blade, it occupies the place and has a good deal of the appearance of a sucking apparatus. Near the posterior margin of the under

Hypopus muscarum. Copied from Dujardin's figure.

Lip of Hypopus. Copied from figure by Dujardin.

CASE XIV.

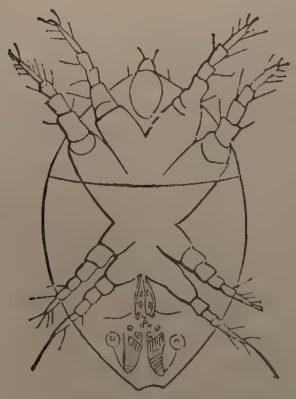
side of the abdomen are the suckers by which it attaches itself. Subsequently, M. Dujardin found other species on other insects, but still without understanding them any better; at last, in the month of September, while searching for Tardigrades on mosses and fern (Ceterach officinarum), he found a Hypopus in sufficient abundance, very similar to the other, but quite distinct, and which lived fastened by its suckers on the shining leaves of that fern, as the other is fixed on the polished coats of insects. But one very remarkable thing came under his notice in studying this mite, namely, that amongst those that he so observed several were narrower, more transparent, and completely empty; some, much more rare and completely immovable, showed in the interior another form of mite, soft, and curled-up like an embryo, and occupying the whole of the internal cavity of the Hypopus, as if the latter had been the shell of an egg, but of an egg living and provided with feet, as the nymph of flies is contained in the shell formed of the hardened skin of the larva. The little mite inside had, according to Dujardin, palpi and chelate mandibles like the Gamasi and Dermanyssi, and he thence arrived at the conclusion, that these Hypopi, without mouth, without possible means of growth, living fixed by their suckers on polished surfaces, from which no nutriment could be derived, must be larvæ, or rather, if the phrase were allowable, eggs furnished with feet, and endowed with motion, in the interior of which, without aliments derived from without, the young Gamasus had to form itself at the expense only of the nourishment contained within. Consistently with this view, Hypopi should be found wherever the Gamasi live, and he maintains that that is just what is the case. On Geotrupes, Necrophorus, and Humble bees, which are



Hypopus filicum.
Copied from Dujardin.

CASE XIV.

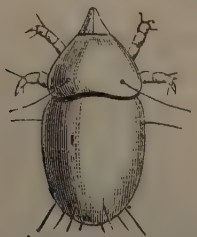
usually so infested by Gamasi, he found almost always Hypopi on the parts of the body which the attacked insect had most difficulty in reaching. He adds, "but as is always the case, I found more than I sought for, more especially larvæ of Acari, of which I had no idea, and whose ulterior form is precisely that of the Acarids that live in the perfect state on the same insects. Thus, the Bombus lapidarius furnished Hypopi quite different from those of Bombus terrestris." By beating the branches or trees, on which certain Gamasi and Dermanyssi live, he found other Hypopi; and lastly, on at least one subterranean rodent, a field-mouse (Arvicola subterranea), which has Gamasi as parasites, he found corresponding Hypopi, but with the remarkable peculiarity, that, as the abdominal suckers would not answer in their case to fix these mites, they were replaced by two salient striated tubercules, as shown in the woodcut, which can approach each other like two lips, so as to lay hold of a hair of the mouse, and so answer the purpose fulfilled by the suckers in the others. In conclusion, he thinks, that he has shown that there are Acari with eight feet, which are, nevertheless, only the first age of other well-known Acari, the Gamasi, which differ from them as much, at least, as the Hydrachnidæ differ from their larvæ. He describes eleven species, which he divides into two sections, one with the back divided by a transverse line near the articulation of the second pair of legs, in this respect resembling the Tyroglyphi; the other not so divided. His Hypopus arvicola has the transverse line across the back, but not the abdominal suckers of either of the others, having, instead, the two tubercles above described.



Hypopus arvicola. Copied from Dujardin.

CASE XIV. For nearly twenty years the above conclusion was accepted by the scientific world as the true account of the development of these Acarids; but in 1868, M. Claparède published the result of his observations on them, which led him to challenge the soundness of Dujardin's view. Claparède found his observations correct to a certain extent, but carried them further, and drew different conclusions. To begin with, he objected that the Hypopus form is eight-footed, which is against its being a larval form; for, as the reader knows, the larvæ of all known Acari appear at first with six feet. Then he took exception to the idea of its being produced from an egg with feet, remarking, with reason, that the exceptional included form had much more analogy with the nymph or pupa stage of other insects. Passing these, which are only theoretical objections, M. Claparède next took a stronger objection, founded on actual observation of the development of the Gamasidæ from the egg. Dujardin had not traced this, but Claparède had, and found that the Gamasus left the egg as a six-footed larva, which already possesses the main characteristics of the mature animal, and in no respect shows any resemblance to Hypopus. He adds, "This objection of mine I will later, I hope, confirm in a treatise upon Gamasidæ;" but, unhappily, his lamented death occurred before he had done so. The observations that he does record are the following. He says that in the neighbourhood of Geneva an Acarus is met with in great numbers, which multiplies itself, in vegetable substances, in great quantities, as in hyacinth bulbs, potato and dahlia roots, half-rotten cabbage-stalks, etc. It was new, but he determined it to be closely allied to the species Tyroglyphus siculus of Robin and Fumouse, and the Tyroglyphus entomophagus of Laboulbène, and described and figured it under the name of Tyroglyphus Dujardinii. He set himself to study this species, and presently he was struck by the remarkable fact that he could find nothing but females. He examined hundreds and hundreds of individuals without coming across a single male. He was hence inclined to think that he had to do

CASE XIV. with a form of Parthenogensis, which we otherwise know does occur among Acarids. In the course of this examination a Hypopus, which continually appeared with Tyroglyphus, attracted his attention, by means of which he hoped to establish Dujardin's hypothesis. But he never succeeded in doing so. He found a Hypopus in the act of metamorphosis, and thereby satisfied himself that it could have no possible relation with Gamasus; and he speaks with confidence, because for three years he brought up Tyroglyphi and Hypopi from hyacinth bulbs in his work-room without ever a single Gamasus making its appearance from or in connection with the others. The Hypopi were in thousands, but they were all of the same size; and the young stage, or individuals in the act of transformation, were not to be found. Neither did he observe any difference of sex, as all examples resembled one another throughout. Nor could any individuals with eggs be found. The manner of increase of the Hypopus thus appeared in the highest degree enigmatical, the more so that the extreme stiffness of the mail-like skin renders the idea of growth after it has acquired it inadmissible. The conclusion forced itself upon



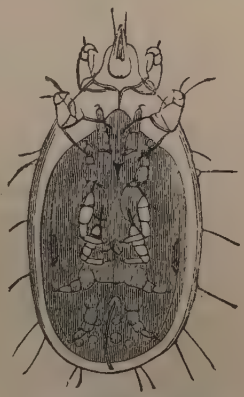
Young larva of Rhizoglyphus echinatus (Tyroglyphus dujardinii, Clap.), the posterior legs not visible from above. Copied from Claparède's figure.

Young stage of Tyroglyphus developing inside of Tyroglyphus dujardinii. Copied from Claparède.

him, that the young stage of the Hypopus must be sought for under quite another form. It next occurred to him that he might succeed better by following the development of the Tyroglyphus from the beginning through its various stages. This he did, and first he found the six-footed larva proceed from the egg, bearing,

CASE XIV. as usual, a close resemblance to the mother Tyroglyphus, as well as to the corresponding six-footed stage of other Tyroglyphi, such as the cheese mite; and he observed in them the development of the second larva, which appears with eight feet, and which bears an even greater similarity to the perfect female Tyroglyphus. Thereafter he followed the further development of this second larva, and traced the progress of its included nymph or quasi nymph, and was witness to the appearance of mature female Tyroglyphi from many of them; but from others, on the contrary, there emerged Hypopi. "There could no longer be any doubt," thought he, "that the Hypopus belongs to the cycles of development of Tyroglyphus," and seeing no other way of explaining or reconciling the facts he had observed, he arrives at the conclusion that Hypopus must be the male form of Tyroglyphus.

Hypopus removed from inside of Tyroglyphus.
Copied from Claparède.



Development of Hypopus, inside Tyroglyphus echinopus.
Copied from Claparède.

That Claparède was wrong in this conjecture was very quickly proved. Two observers of the highest competency, Professor Robin and M. Fumouse, had been studying the same Tyroglyph as Claparède at the very same time, and in the same year they published the result of their researches, and we believe their paper had the priority by a few months.*

* It appeared in the Journal de l'Anat. and Physiol. de C. Robin, in the number for May and June 1868; Claparède's appeared in the Zeitschrift fur Wiss. Zool. Bd. xviii., 1868. We do not know the month, but presumably at the end of the year.

CASE XIV.

They described the species under the name of Tyroglyphus echinopus, and Claparède's name, dujardinii, must give way to it; but, unlike Claparède, they found both males and females, and figured them in their paper, and both are of the normal form of other Tyroglyphi. It is therefore impossible that the Hypopus can be the male of Tyroglyphus.

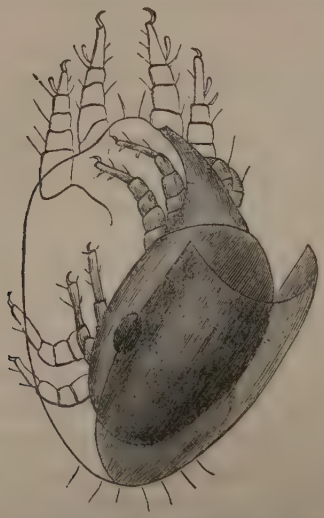
Up to this point, however, there does not appear to be anything in the facts observed by Claparède that is incapable, or even very difficult of explanation. Hypopus is already known as an external parasite on insects. May it not also be an internal parasite in its earlier stage; and might not Claparède's supposed male, seen first inside the Tyroglyph, and afterwards emerging, be that stage. Such a double phase of parasitism is not without precedent in insects. Rhipiphorus paradoxus passes its earliest stage inside the grub of the wasp, then emerges while still minute, and, fastening on its outside, finishes off its victim. Subsequent dis coveries, however, have introduced new and surprising elements, apparently inconsistent with such an explanation. In 1873, M. Megnin (first in the "Comptes Rendus," and then in M. Robin's "Journ. Anat. Phys."), published the results of a long continued and careful observation, undertaken to solve the true relations of the Hypopi and Tyroglyphs, taking for his subject another Tyroglyph (which he named Tyroglyphus rostroserratus), which was very plentiful in the common mushroom (Agaricus campestris), and very destructive to the mushroom cultivation around Paris; and in 1874 he published, in the same work, further researches on it and another mushroom-feeding species (which he named T. myceticola). The importance attached to his researches may be judged from the fact, that for them he received from the Academie des Sciences the Thoré prize of 1873. He placed his specimens in cages specially provided for them, supplying them with shreds of mushrooms which served both as food and lodging for them. In observing these, one of the first facts that struck M. Megnin was, that so long as the mushrooms were moist and in full decom-

CASE XIV. position, myriads of Tyroglyphi swarmed in his boxes; when, on the contrary, the mushrooms on which they lived began to dry up, his numerous Tyroglyphs disappeared in great part, and were replaced by legions of a particular Hypopus, having all the characters of Hypopus feroniarum of Dufour, or the H. dugesii of Claparède.

On renewing the provision of mushroom, which restored the moisture, it was the Hypopi which disappeared in their turn, replaced by myriads of Tyroglyphi. Twenty times the same phenomenon was reproduced before his eyes. Persuaded that these Hypopi must change their form in moulting, he had isolated them at different times in small cages of glass, but without success: they remained inert, sticking to the walls of the cage, and as if deprived of life. The idea then occurred to him to place them in contact with fresh mushrooms, and accordingly he placed in their cages fragments of mushrooms completely freed from eggs and animalcules. "In these new conditions," says M. Megnin, "the Hypopi moulted and transformed themselves under our eyes into small octopod Tyroglyphi, not yet adult. This fact shows," says he, "that the Hypopus is a transition stage of Tyroglyph; but does the Hypoyus come from the eggs, or is it the result of the transformation of hexapod larvæ, or of nymphs?" and he gives the figure in the accompanying woodcut of the act of transformation which he saw.

In pushing his researches further, he succeeded in finding an inert octopod nymph, containing in its inside a Hypopus, ready to change, in other words, he re-discovered what Claparède took for the male. The result of his observations is thus stated: "Here is what has been well shown. There are nymphs of Tyroglyphus which transform themselves into Hypopus; and, reciprocally, Hypopi which re-become nymphs of Tyroglyphi." And the conclusion deduced from it is that "Hypopus is nothing but a cuirassed adventive heteromorph, charged with the conservation of the dissemination of the species of Acarid which

CASE XIV. passes through that form in its evolution." The rationale suggested for such an unusual phenomenon is, that Hypopus is a stage with



Sketch of Tyroglyphus mycophagus emerging from Hypopus. Copied from Megnin's figure.

a harder skin in the development of Tyroglyphus, specially provided for it to compensate for its softness and aptness to be dried up on the failure of moisture which, but for this provision, might extinguish the race.

The above is, we think, a statement of the facts and inferences relating to this puzzling phenomenon, and the reader must form his own judgment upon them. We shall only point out how far M. Megnin's observations really go, where they seem to correspond or differ from those of Claparède and other observers, and what blanks still remain to be filled up before we have a complete knowledge of the life-history of Hypopus and Tyroglyphus.

In the first place we have mature Tyroglyphi, male and female, the latter of which lay eggs.

CASE XIV. Next, these eggs produce young Tyroglyphi, exactly after the type of their parents, but with only six legs. See first figure on p. 238. This is the usual first stage of development in all acarids.

It is not until the young animal has passed from the six-legged into the second or eight-legged unsexual stage that either Claparède or Megnin begin to see any other form inside either Tyroglyph or Hypopus. The figures they give of such incidents all represent both outer and inner animal as eight-legged.

It is only when it approaches the nymph stage (towards the end of the first sexual eight-footed stage, which is the third stage of development) that the internal transformation is first seen. At that stage Claparède saw and gives the figure of a young eight-footed Tyroglyph with another Tyroglyph inside, which we have reproduced (second figure on p. 238); and Megnin saw and gives a figure of a Hypopus with a Tyroglyph inside, and another figure of a Tyroglyph bursting its way out from the shell of a Hypopus, both eight-footed, which we have copied, p. 242. Both agree that it is a Tyroglyphus that is within, and that comes out; but Claparède says it is inside a Tyroglyphus, and Megnin, inside a Hypopus, and Dujardin that it is a Gamasus inside a Hypopus. Have these gentlemen been looking at the same thing, or do their figures represent different events happening at different stages in the life of the same individual? If the former, then it seems clear that it can only be determined by further experiments made by some other equally competent observers. If we take both as happening, but happening at different stages, then it is clear that by doing so we diminish the probability of one of them; for changes by development are only accomplished at the periods of moulting, and as these are limited in number, each additional change introduced reduces the opportunities of effecting it. We presume that it will never be possible to ascertain, by actual observation, the exact number of times that these mites change their skin; but the number of times is said to be four, and at all events there are

CASE XIV. only four recognised stages of progress, besides the egg, as proved by Robin in his paper on the Dermaleichi (1868); the six-footed stage, the young eight-footed stage without sexual organs, the eight-footed nymph with internal but without external sexual organs, and the perfect mature insect, with both internal and external sexual organs. If to these we are to add two Hypopus stages, and two shiftings back to Tyroglyph, as required by M. Megnin's hypothesis, it complicates the matter considerably. The only at all feasible way out of the difficulty is by supposing that M. Dujardin and M. Megnin on the one hand, or Claparède on the other, had made a mistake in the kind of species that contained the other. That may be possible, and if that is the only alternative offered us, men must judge for themselves whether they think it more likely that M. Claparède or M. Megnin (and we ought to add M. Dujardin) shall have made such an error. Either will remove much of the difficulty. If it be the latter who are in error, all the phenomena seem explicable on the supposition of Hypopus being an internal insect parasite. If it be M. Claparède, then MM. Dujardin and Megnin have got their way cleared of at least one stumbling block. If neither have been in error, we have the following curious succession of development. 1. Egg of Tyroglyphus. 2. Six-footed young stage. 3. Eight-footed unsexual stage. 4. The eight-footed form seen by Claparède within the preceding, and which must have been the nymph without external sexual organs. 5. The Hypopus with a totally different system of nutrition. The change from the preceding to this has not been seen, and is yet to be proved, indeed, no connection between the Hypopus at this stage and any precedent form of Tyroglyphus has been shown. This has next to turn into, 6. An eight-footed Tyroglyph, presumably a nymph, and, 7. Back again to a Hypopus, which has been traced no further, but which must, on the hypothesis of its being a phase of development, in turn change into the final change (which would make the eighth), the perfect insect.

CASE XIV. It humbly appears to us that there must be some error here. We render all justice to the painstaking truthfulness of M. Dujardin and M. Megnin's observations. They are no doubt two to one, but we must remember who the one is. Claparède was one of the most distinguished physiologists, and most careful and accurate microscopic observers of the present generation; and as Claparède's observations, now in the balance, lead to no incongruous or unprecedented results, we own that we feel a preference for them. If MM. Dujardin and Megnin are in error, its extent would be the mistaking the containing mite for a Hypopus while it was only a Tyroglyphus; and the very considerable resemblance that there is on a superficial view between the earlier stages of Hypopus (so far as known) and Tyroglyphus, is the more suggestive of the possibility of such a mistake.

As regards the observations of Dujardin, he is either in error in supposing that the contained mite was a Gamasus; in which case his authority as to identity of the containing mite is weakened, or if he is right and M. Megnin right, then Hypopus forms not only a stage in the development of Tyroglyphus, but also of Gamasus. We must always remember that we are investigating the development of an animal so minute, that it passes the portion of its life now in question in the inside of a mite no larger than its relative the cheese mite.

As to M. Megnin again, his own account of his observation contains one or two facts which seem to lend support to our suggestion that, in its early stage, Hypopus is an internal insect parasite. In his paper above mentioned he says, "On the 14th of April, 1869, while preparing a Trombidium holosericeum for anatomical study, we were much surprised to find, among the red and branched hairs of this large Acarid, three Hypopi, in all respects similar to that found on an ox by M. Deyrolle. In fine, eight days later, having collected in a truss of old decaying hay a great quantity of Gamasi and other Acarids, we found a female Gamasus, to which adhered two Hypopi, in all respects similar to

CASE XIV.

the preceding. One of these Hypopi was fixed on the back, and the other on the abdominal face, in such a manner, that looking at the Gamasus from its upper side, its parasites both appeared as if in the abdomen, and we entertained for a moment the conviction that we had, under our eyes, the proof of the truth of the assertion of Dujardin that our Gamasus was about to bring forth a living larva with a Hypopial form. We know, says he, that some Gamasidæ, the Pteropti amongst others, bring forth living octopod larvæ.

"Opportunity having permitted us to meet several times Hypopi attached to Gamasi, and to study them in all their phases, after having also encountered the veritable larvæ of Gamasi, always similar to their parents, whether hexapod or octopod, we have *thus acquired the proof that we had been the plaything of an illusion* and that the Hypopi are not the normal larvæ of Gamasi as Dujardin supposed." We have quoted this passage entire, and in Megnin's own words, first to show the wide dispersion of the Hypopi among insects, which, according to our view, is consistent with its being a general parasite seeking whom it may devour, but inconsistent with its being a phase of developement of a particular insect; and, second, to show, by the words we have printed in italics, that M. Megnin really did see a Hypopus inside of a Gamasus, but disbelieved his eyes, and regarded himself as the plaything of an illusion, not from any correction of his observation, but from abstract reasoning that it could not possibly be correct. He reasoned himself out of his own senses. It looks as if he had made up his mind that anything inside the Gamasus could only be a phase of Gamasus; and as from independent observation he was sure that its larvæ was different, he came to the conclusion that what he saw was not there, but somewhere else, and only appeared to be there by an optical illusion.

This is not the only insect besides Tyroglyphus, that the Hypopus has been found in. Mr. Tatem described and figured (Monthly Micro. Journ., 1872) a Hypopus under the name of

CASE XIV.

Acarellus muscæ, which he took from "the abdominal cavity of a dead flea." Qu'allait-il faire dans cette galère, if it was a phase of a vegetable-feeding Tyroglyphus; neither could there be any question of development between a flea and a Hypopus. But it was a very natural place if the creature is an internal parasite. Again, Dr. Maddox (Monthly Micr. Journ., 1871) describes and figures a Hypopus that he obtained from a bat's ear, that was swarming with the larvæ of a parasitic tick that we have already and shall again have occasion to speak of. If a phase of Tyroglyphus, it could hardly have mistaken a bat's ear for its natural food, a hyacinth bulb. If a parasite, it might very naturally be found among the ticks on which it preys; and what adds value to these two observations is that they were both made by observers who appear to have made no special study of the Acarids and who were ignorant of Hypopus and its points of interest. Mr. Tatem supposed that his Acarellus might perhaps have something to do with Phytoptus, and Dr. Maddox goes no farther than to call his a single minute insect found free amongst the hairs along with specimens of the other mite he there found and adds "(? immature male)":—but the figures given by both Mr. Tatem and Dr. Maddox are unmistakably Hypopi. It is also not irrelevant to remind the reader of Dujardin's observations regarding a Hypopus found on or in connection with a parasite of the field-mouse, which, from his description, is doubtless Myobia musculi; and to add that a careful examination of the description of Dr. Maddox's mite found in the ear of a bat, has satisfied us that its generic place is not with the Pteropti, but with the Sarcoptidæ, and next to Myobia musculi.

Another circumstance observed by M. Megnin in his study of the Tyroglyphi and Hypopi, the successive disappearance of Tyroglyphi, appearance of Hypopi, and re-appearance of Tyroglyphi in his boxes, suggests the remark that, on our hypothesis, it presents none of the difficulties of explanation which attend it on his. On the mushrooms becoming dry in his cage

CASE XIV.

(which shews an insufficiency of moisture for the wants of the Tyroglyphi), they disappeared, that is, dried up and died. On the death of an insect containing parasites, these latter usually, if they can, make their way out and anticipate their period of passing into the pupa state; so here on the death of the Tyroglyphi the Hypopi made their way out, but only to die;—"they rested inert on the walls and as if deprived of life." He never says that they revived, but he says they disappeared on (but it does not follow that it was in consequence of) fresh mushrooms being introduced into the cages. Our understanding of this would be that they had really died when they seemed deprived of life. But fresh swarms of Tyroglyphi now succeed them. Why not? There might still be plenty of Tyroglyphi living to replenish the stock now that fresh food was introduced; for in speaking of their first disappearance, he does not say that they wholly disappeared, but "disappeared in great part." But besides this, in introducing fresh mushroom-food, even with every care to exclude eggs or Acari, there is always a great chance of their getting admission in spite of every precaution.

Further, if our hypothesis be right, it helps to explain how Claparède and others have failed to find any six-footed larvæ of Hypopi going about free. At that stage we assume them to be in the inside of other insects. Other puzzling points in the economy and life-history of these creatures still remain awaiting elucidation. As yet no sexual organs have been found in them,—which, so far as it goes, is a point in favour of M. Megnin as indicating immaturity and progress of development.

Again, what are the great clusters of them that are seen adhering to other insects, doing there? They are not on the insect for purposes of feeding, for they have no mouth, or if they had, they could extract nothing out of the polished armour of such insects as the Histeridæ, to which they cling. They cannot be there for the purpose of laying eggs in the insect's body, even supposing that mature males and females are there, although no

CASE XIV.

sign of sex is distinguishable, because it is notorious that so far from a crowd of parasitic insects selecting the same insect as the host in which to deposit their eggs, they carefully avoid placing them in any insect that has already had eggs placed in it by another; their instinct in this matter teaching them contrary to the axiom acted on by many human couples, that what is enough for one is not enough for two. They must, moreover, leave their host at some time or other, and when they do so, they may, of course, be found elsewhere than on insects. Can they be individuals that have passed their parasitic life inside the insects, and are now enjoying their *otium cum dignitate* idly on its outside? But how did they get out, having no mandibles? They could not eat their way out. It is not like the thin shell of a Tyroglyphus, which may be cracked by muscular action. And whence come so many? It is true that although a Tyroglyphus may only hold one, a fly might hold many.

Yet again, how come one or more species of Hypopus to be found habitually, not on insects, but on ferns? In speculating on this we must remember that we have plenty of instances, among insects, of species of the same genus having different habits. In this very group we have one section of Tyroglyphi living on vegetable and another on animal matters—we have most of the species of Glyciphagus feeding on sugared fruits, but other species parasitic; and it adds to the probability of its being so here that there have been two species of Hypopus found on ferns, and that they both, although distinct, have the same cachet or type of make. They belong to a separate sub-genus of Hypopus. The same remark applies to the specially endowed species found on the field-mouse. It may have special habits as well as special structure.

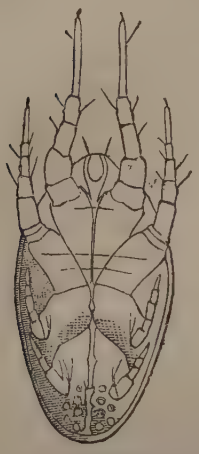
Passing from the consideration of this very curious and puzzling animal, let us now glance at some of the different species of the genus.

CASE XIV. HYPOPUS MUSCARUM (*Linn.*). See figure on page 234.

On flies.

HYPOPUS ALICOLA (*Duj.*).

On the wing of a bee.



Hypopus alicola. Copied from Dujardin.

No. 3. HYPOPUS MUSCÆ (Acarellus muscæ, *Tatem.*, Monthly Micr. Journ. 1872, pl. xl. 263.).—**3.** Magnified sketch of ditto, copied from Mr. Tatem's figure.

An elongate form, like H. alicola Duj. Dujardin obtained his specimen from the humble-bee; Mr. Tatem his from a small dipterous fly.

No. 4. HYPOPUS PULICIS (Acarellus pulicis, *Tatem*, loc. cit.).—**4.** Magnified sketch of ditto, copied from Mr. Tatem's figure.

Found by Mr. Tatem in "the abdominal cavity of a dead flea." It comes very close to Hypopus lævis of Dujardin, the chief difference seeming to be that its posterior pairs of legs are scarcely quite so robust; but as Mr. Tatem mentions that these legs were only visible through the skin, and not yet free, it may be that his specimen, not being yet closed, was not perfectly developed, and that the legs might afterwards have become somewhat stronger. We have already alluded to the significance of the locality in which it was found by Mr. Tatem.

HYPOPUS FILICUM (*Duj.*). See figure on page 235.

On the fronds of Celerach officinalis.

HYPOPUS ARVICOLA (*Duj.*). See figure on page 236.

On the field-mouse.

CASE XIV. There have been about twenty species of Hypopus described, Dujardin having subsequently added a few more to those previously mentioned.

Here, perhaps, should follow one of Hering's species found by him on dried figs, and which he named Acarus passularum (Nov. Act. Cur. 1838). It has been supposed to be a Hypopus, but the uncertainty in which many points have been left by him, which have since been found to be of importance, prevents more than probable conjecture as to the genus to which the species he has figured belongs. The figure he gives certainly does not look like one.

Genus TRICHODACTYLUS (*Dufour*, Ann. Sc. Nat., 2nd Ser. xi. 1839).

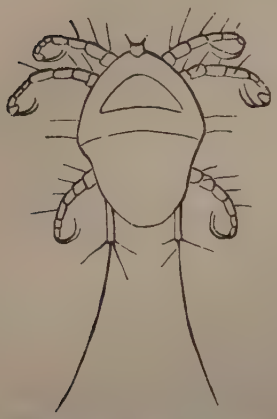
This genus was proposed in 1839 by M. Léon Dufour for one or two species of parasitic mites found on bees. The name is derived from the last pair of feet terminating in one or more long hairs, instead of in a tarsus or claw. They have obviously much affinity with Hypopus, both in habit and structure, the posterior legs of which terminate in something the same manner; so much

Leg of Trichodactylus Osmiæ. Copied from Donnadieu's figure.

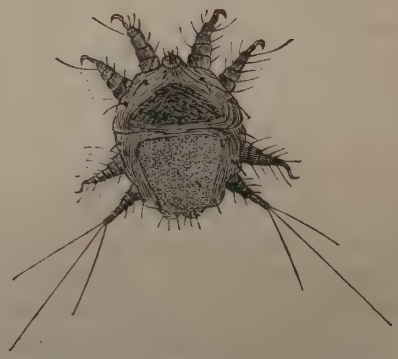
so that Dujardin regards them as belonging to the same genus. But we think that the more powerful make and claws of the first three pairs of legs in Trichodactylus, combined with the rudi-

CASE XIV. mentary character being confined to the last pair of legs, is sufficient to make a sub-genus for their reception necessary. We give figures of the two that have been described: nothing is known of their development as yet.

TRICHODACTYLUS OSMIÆ (*Duf.*).



Trichodactylus osmiæ. Copied from original figure by Dufour.



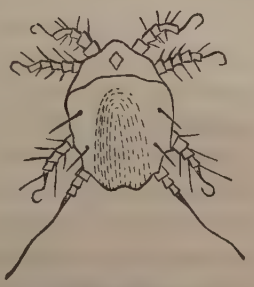
Trichodactylus osmiæ. Copied from figure by Donnadieu.

Found on a species of Osmia. It will be seen that it has the mouth-piece of Hypopus with its two projecting bristles.

No. 5. TRICHODACTYLUS XYLOCOPÆ.—**5.** Magnified sketch of ditto, copied from figure.

Found on Xylocopa violacea. There is some appearance of transverse lines on the surface of this and the preceding species, but we have had no means of ascertaining how far they are of the same character as those on the Sarcoptidæ. The hair termination of the last pair of legs undoubtedly has some affinity to that group, and it is obvious that we are approaching its terri-

CASE XIV. tories; but in several true Hypopi the last legs likewise terminate in a long hair, and the other more important characters indicate that its nearest relations are with them.



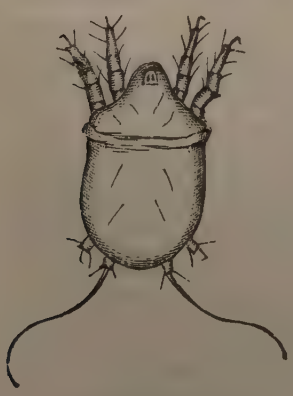
Trichodactylus xylocopæ.

Another species was described in 1845 by Dr. Gros in the Bull. Soc. Imp. Mosc. S. 397, under the name of Scutacarus femoris. He found it, he says, in the nests of Hornets, and beside the mites of Hister unicolor. The description shows that it belongs to this genus.

Another form which may perhaps also be connected with Hypopus is the

Genus HOMOPUS (*Furst.*).

No. 6. HOMOPUS ELEPHANTIS (*Furst.* Kratz-milben, 222), (Symbiotes elephantis, *Gerl.*).—6. Magnified sketch of ditto, copied from Furstenberg's figure.



Homopus elephantis.
Copied from Furstenberg's figure.

The only claim that this has to be called "elephantis," consists in its having been found on the hide of a stuffed elephant; but we do not even know how long the skin had been stuffed. Gerlach thought

it an itch mite, and named it Symbiotes elephantis; but it wants the suckers to the tarsi and the transversely striated skin; and in Furstenberg's figure it is provided with chelate mandibles

CASE XIV. and palpi, and with the characteristic chitonous bands which support the legs in the sarcoptidæ, although in a less degree. Claparède, although he does not say that he has seen the insect itself, boldly says (loc. cit.) that Furstenberg is wrong, both in his figure and his description, and disputes the existence of these mandibles, and declares it to be a Hypopus. There is certainly much in it that is characteristic of Hypopus, but unless Furstenberg has been incredibly careless and inaccurate, and we are at liberty to re-draw it in accordance with our own notions of what is most probable, it seems impossible to bring it in the same line with that genus. We quite agree with Claparède, however, that it must be near it, and have dealt with it accordingly.

Furstenberg mentions that he found a similar mite under a number of Horse Mites (Dermatokoptes), which he got from a horse suffering from the itch. The same species turned up again in Paris in 1867. In the Universal Exposition of that year a magnificent ox, splendidly stuffed, was a conspicuous object in the glass-case of M. Deyrolle, the naturalist. Regarding this ox, M. Megnin learned from M. Deyrolle that when he was occupied in mounting the skin, which had been left for eight days in a bath of alum, he was witness of a singular phenomenon. The skin became covered with myriads of very small white Acarids scarcely visible, and which gave the effect on the skin of a dusty matter. He collected numerous specimens which he gave M. Megnin, who on seeing them immediately recognised a Hypopus which resembled line for line the Homopus of Furstenberg, only its carapace was finely granulated, a detail which he suggests the German author had perhaps neglected, and moreover he found it impossible to make out the jaws and palpi which he describes. The mouth was simply a "rounded opening, closed as by a 'clapet' by a movable lip furnished with two hairs." *

* Probably here should follow the genus Heteropus, which we have placed at the end of the Tyroglyphidæ as of uncertain position, not being able to make up our mind as to its most suitable place.

CASE XIV.

Sub-family TYROGLYPHIDÆ (Cheese Mites and their allies).

The general characters of this section are a soft, smooth, fleshy, whitish body, without any system of striæ, or lines, disposed around the body, but with a slight furrow, depression, or line of separation, on the back between the second and third pair of legs marking off the thorax from the abdomen—Mandibles chelate. The tarsi in most species, although not in all, have only a single claw, which is surrounded by a vesicle, or fine sucker, like a sleeve. In a few species there is only a claw and no sucker.

The group consists of the following genera—Rhizoglyphus, Tyroglyphus, Glyciphagus, and Cheyletus, which may be distinguished by the following characters:—

Rhizoglyphus, Tyroglyphus, and Glyciphagus have the typical characters above mentioned, but are distinguished from each other by the two former having the hairs on the back smooth, while in Glyciphagus they are hairy, plumose, or feathered, and in it there is also a posterior appendage in the females, like a knob at the tail, or an *os coccygis*. Rhizoglyphus again is distinguished from Tyroglyphus by having tarsi with claws, and without suckers, while Tyroglyphus has both a claw and sucker.

Cheyletus is distinguished by its enormous mandibles, by a peculiar tracheal system, and by having two claws, and other appendages to the tarsi.

Genus TYROGLYPHUS (*Lat.*).

Sub-genus RHIZOGLYPHUS.

Tarsi with claws and without suckers. Feeds on vegetable substances.

Claparède (loc. cit.) proposed in 1868 a genus under this name for a species of Tyroglyphus, which we shall presently

CASE XIV.

notice; but although we adopt his section and his name, we do not adopt his character, nor confine it to his species, and, therefore, cannot quote it as his genus.

The chief characters, as defined by Claparède, were that the two right and left abdominal suckers are present both in the male and female, instead of being so only in the male, as in the normal Tyroglyphi, and that the third pair of legs are disproportionately large. Both of these characters seem to us merely specific. We have seen, when speaking of Hypopus, that the number and distribution of abdominal suckers vary in every species, and an abnormal thickening of legs in one sex is a not uncommon variation in species of many genera of insects. But Messrs. Fumouse and Robin, in describing this Tyroglyphus (T. echinopus), pointed out that it had no sucker annexed to the tarsi. They did not propose to make a new genus for the species on that account, but proposed to alter the character of the genus Tyroglyphus to admit their species. Hitherto the character ascribed to the tarsi had been a claw with a sucker. Now the T. echinopus of Fumouse and Robin has no sucker,

Tarsus of Rhizoglyphus.

Tyarsus of Tyroglyphus

neither has Claparède's Rhizoglyphus robini (his Hypopus dujardini is the same as T. echinopus); both with similar habits, viz., feeding on hyacinths, and, what is more, having the common character of living on vegetable substances; whilst the others (the Tyroglyphi) affect animal remains, cheese, dead insects, &c. For the former we suggest that Claparède's name

CASE XIV. and Fumouse and Robin's character should be taken. Claparède's characters will not apply to *their* species, but *their* character will apply to both, and distinguish the little group composed of them sharply from Tyroglyphus.

Nos. 7, 8, 9, 10. RHIZOGLYPHUS ECHINOPUS (Hypopus dujardinii, *Clap.*). — **7.** Magnified sketch of larva and pupa ; **8.** Magnified sketch of supposed male (Hypopus) ; **9.** Magnified sketch of female. All copied from Claparède's figures. (Tyroglyphus echinopus, *Fum. & Rob.*, Journ. Anat. and Phys. de M. Robin, 1868) ; **10.** Magnified sketch of ditto, copied from Robin's figure. (? Acarus hyacinthi, Boisd. Ent. Hort., p. 86.)

Larva of Rhizoglyphus echinopus. Copied from Fumouse's figure.

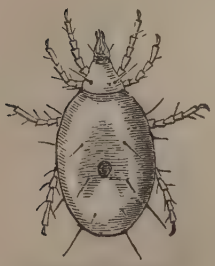
Besides the generic character above noticed, the most notable points in this species are more numerous bristles about its feet than in other species, and a more globose body, there being no drawing in of the flanks, as is often, more or less, seen in other species. As we have already said, under Hypopus, Claparède's and Robin's species are the same. There can be little doubt that the species noticed (in the same year) by Boisduval in his "Entomologie horticole," under the name of Acarus hyacinthi, also belongs to this, although the absence of any description prevents our saying so with certainty.

The habits of their species, as observed by all three authors, were identical. They live between the scales of some species of Liliaceæ, principally hyacinths. M. Boisduval adds, that in some years they are very abundant in autumn, and occasionally cause itching and irritation to those persons who handle a great number of the bulbs.

It is not improbable, however, that it is only because the hyacinth bulbs are more exposed to view than the roots of other

CASE XIV. plants that the mite has been observed chiefly on these bulbs. We have observed in numbers, on the roots of vines attacked by Phylloxera, a species which we cannot distinguish from T. echinopus; and it seems not unlikely that it may hereafter be found on roots generally. We found Hypopi in its company on vine roots.

RHIZOGLYPHUS PHYLLOXERÆ (Tyroglyphus phylloxeræ, *Planchon and Riley*, 6th Report, 1874, p. 52).



Rhizoglyphus phylloxera. Copied from Riley's figure.

Mr. Planchon in his work on the American vine, and Mr. Riley (loc. cit.), records the presence of this allied species in North America. They found it in association with the Phylloxera of the vine, feeding in its young state on the juices of the roots injured by Phylloxera; and, when older, preying extensively on the root-inhabiting type of that insect. Mr. Riley mentions that when this fact was published, it was hoped that the introduction of the Rhizoglyphus into Europe might be of service in reducing the numbers of Phylloxera, and he received orders from vine growers in France for a supply of the cannibal. Mr. Riley, however, although he endeavoured to comply with the request, did not anticipate that it would do much good;—in which we agree with him, chiefly because they have already in France commonly associated with the Phylloxera a Rhizoglyphus, which we believe to be the preceeding species; and the one should certainly be as good as the other as an exterminator, if that class of mites really did feed upon other insects; but the statement of Messrs. Planchon and Riley to that effect has been received with doubt by some French entomologists. We have not seen M. Planchon's statement, and we observe that Mr. Riley does not say how he ascertained the fact; but he makes the assertion broadly, and as he is well-

ASE known to be a careful and accurate observer, any statement of his
XIV. is entitled to great weight; but, like all of us, he is liable to error, and may have been deceived (as sometimes happens), by abnormal conduct under abnormal circumstances. There are many instances of insects that are vegetable feeders having eaten their neighbours when shipwrecked into an entomologist's box or breeding cage. Dr. Fumouse, who has studied the habits of the Tyroglyphi more closely than perhaps any other living naturalist, objects to the idea as being opposed to the habits of all other Tyroglyphi, which never attack living animals; and, further, because although not rare in France on vine roots attacked by Phylloxera, there never has been any appearance of their number being diminished by them (see Ann. S. Ent. Fr. 1874, Bull. 98). It is, moreover, opposed to the habits, so far as hitherto known, of the section of Tyroglyphi to which it belongs; for that section feeds exclusively on vegetable food.

Both M. Planchon and Mr. Riley have found Hypopi in this species.

0. 11. RHIZOGLYPHUS ROBINII (*Clap.* loc. cit.).—11. Magnified sketch of female, copied from Claparède's figure.

Found by M. Claparède in company with his H. dujardinii upon hyacinths, and also on potato and dahlia roots, and, as he himself says, capable of being easily confounded with dujardinii in its course of development; but when mature, the female is readily recognisable by her very thick and clumsy third pair of legs, which occupy so much space that they throw the fourth pair further back than usual.

RHIZOGLYPHUS (?) FECULÆ (Tyroglyphus feculæ, *Guer.*, Ann. Soc. Ent. Fr. 1867).

It is probably to this genus that the species named Tyroglyphus feculæ belongs. M. Guerin-Méneville records its sudden appearance in very great numbers in some heaps of Australian

CASE XIV. potatoes shut up in a barn of the annex to the imperial farm at Vincennes. What was most remarkable was the immense quantity of them that were developed in less than eight days. The soil of the ground floor, where the potatoes had been placed, was covered with a bed of this little Tyroglyphus, which looked like an animated dust of a grey colour. A sample of this living dust, which M. Guerin-Meneville had collected, was composed of myriads of millions of these little animals, and was swept together in some minutes and simply by the help of the feather of a pen. This mass of beings was composed of a reunion of individuals of all different ages and degrees of development.

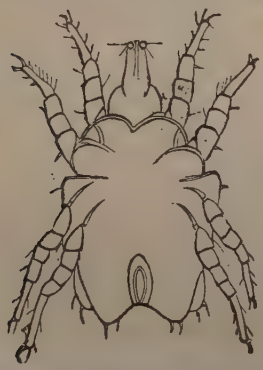
This innumerable assembly had attracted, as is always the case, many other little hunting insects, who had found there an abundant and easy prey. There were larvæ and perfect insects belonging to several genera, Coleoptera, Hemiptera, Hymenoptera Diptera, etc., on which these mites had attached themselves in commensurable quantities, literally covering them and giving them a most singular appearance.

The potatoes, which looked quite sound and healthy, were all covered with these Acarids. As these latter could no longer all hold on to the surface, they accumulated between the paving-stones, thence even on to the pavement, where they formed a bed of several millimètres in thickness on a surface of about four square mètres.

RHIZOGLYPHUS ROSTRO-SERRATUS (Tyroglyphus rostro-serratus, *Megnin*, Journ. Anat. Phys. 1873; Acarus fungorum (?) *Boisd.* Ent. Hort. 1867, p. 90).

This is the species on which M. Megnin made the observations on the development of Hypopus, which we have above recorded. We have already mentioned that around Paris the cultivated mushrooms, more especially the common Agaricus campestris, are often attacked by a moist black rot, which, until lately, had been regarded as spontaneous. M. Megnin has shown that it is caused,

CASE XIV. or at all events actively aided by, two parasites, an Anguillula and a Tyroglyphus, which are remarkable for their prodigious fecundity



Tyroglyphus rostro-serratus, under-side. Copied from Megnin's figure. About size of cheese-mite.

Ditto, side view. Copied from Megnin's figure.

when they find themselves in conditions favourable for their development. The proof that these creatures are the very active although indirect agents of this putrid decomposition, is that mushrooms on which they have been placed are, in less than forty-eight hours, reduced to a state of black and deliquescent putrescence, on which myriads of these animalcules swarm; while other mushrooms in the identically same condition, which have not been subjected to that inoculation, and which have been isolated from the spoiled mushrooms, dry up or become mouldy, and take from eight days to a fortnight to decompose spontaneously.

The Tyroglyphus rostro-serratus is a sociable Acarid. It is always, in great troops, in which all the ages are represented, that it lives on the mushrooms in course of decomposition. It has a life in some sort amphibian; for from the moment when the mushroom begins to decay, to take a brown colour and become humid, it is in the stratum of liquid half a millimètre in depth which covers the surface of the fungus that the Tyroglyphi in question move about completely bathed in this liquid, and in the midst of

CASE XIV. myriads of anguillulæ which often swarm there. It looks sometimes as if they darted their sharp mandibles into these creatures; but this is an illusion, and it is truly the vegetable cells that they shear asunder with their scissors-like mandibles. These are shown in the woodcut.

The species is at once distinguishable by its rather rectangular form and by the back being raised in humps as shown in the figures.

It seems very probable that this species, described in 1873 by M. Megnin, is the same as that noticed by Boisduval in 1867; but, as the notice by the latter contains no description, it is impossible to give the preference to his name even although it should turn out that he meant the same species as M. Megnin. All that Boisduval says of it is, that he had observed, when he had descended into certain parts of the catacombs or in the quarries occupied by mushroom growers, that the common mushroom Agaricus edulis, was often invaded by an Acarus visible to the naked eye, which covered the pedicule and spread itself even between the folds of the pileus. It is, he adds, along with a small brachelytrous beetle, which the mushroom growers call capuchin, a scourge for this kind of culture. All the description he gives of it is that it is roundish and of a feeble rusty grey colour.

RHIZOGLYPHUS MYCOPHAGUS (Tyroglyphus mycophagus, *Megnin*, Journ. Anat. Phys. 1874).

This is another mushroom-feeding Acarid from which M. Megnin obtained some of his more important facts regarding the

CASE XIV. transformations, or supposed transformations, of Hypopus. It is a long smooth species with a projecting sow-like snout. In accordance with his opinion that Hypopus is only a stage of Tyroglyphus, he gives as a synonym of it the Acarus spinitarsus of Hermann, which is undoubtedly a Hypopus.

Figure of Tyroglyphus mycophagus. Copied from Megnin's figure.

Nos. 12, 13.

Sub-Genus TYROGLYPHUS (*Latr.*)

Feeds on animal products. Tarsi, with suckers and claw.

TYROGLYPHUS ENTOMOPHAGUS (*Laboulb.*, Ann. Soc. Ent. Fr. 1862.)—12. Sketch of a particle of dust from an insect drawer much magnified, showing the mite in various stages, eggs, broken fragments, &c.; 13. Magnified sketch of insect.

The Tyroglyphus entomophagus is the smallest of all the known species of this genus. It is remarkable for the parallelism of the sides, and cylindrical appearance of the body, and for its narrowness, especially in the female. Its legs are shorter than in the other species.

It is a species only too well known to Entomologists. It takes up its abode in entomological collections, in the interior of the body or on the surface of the insects, and in the dust which gathers at the bottom of the drawers or boxes. Large insects, with the body full of fatty particles, those which have not lived long or which have been brought up in captivity, and which have not paired, and those which have *become greasy*, (to use the technical expression), are the most liable to attack. Certain families of Coleoptera, the large Scarabæidæ, like Oryctes and Geotrupes, the Lucanidæ, the Carabidæ, the Dytiscidæ, and the Hydrophilidæ, the Cerambycidæ, the large or badly dried Blaptidæ, may often be seen covered on the surface with excrement and eggs,

CASE XIV.

under the form of white dots, and sometimes contain a considerable number of these Tyroglyphi in the interior of the body.

The body of the large, especially the nocturnal Lepidoptera, the Cicadæ amongst the Hemiptera, the Earwigs, etc., etc., have them likewise, and the quantity sometimes furnished by such insects, where the mites have once obtained a footing, is truly enormous.

The Tyroglyphus entomophagus may be found running upon the back of dead insects, and may be seen without the aid of the microscope. According to M. Perris it gnaws the down and the hairs of the insects attacked. It is, however, chiefly in the inside of their body that it lives: it gnaws and dilacerates all substances that are soft or deprived of chitine; hence they are specially destructive to Lepidopterous insects. In handling insects that have been attacked by these Tyroglyphi, we are apt to cause the articulated pieces of which the ligaments have been destroyed to fall asunder, and then there issues from the body a friable matter in which the living Acari swarm.

The friable matter which falls out, when the body of insects gnawed by the Tyroglyphus entomophagus is shaken, is composed (as shewn in the sketch in this case): 1st, of the excrement of these animals in the form of little rounded greyish masses; 2ndly, of the eggs in course of development, and of empty shells of hatched eggs, of open and bent shells, cracked often longitudinally; 3rdly, of young larvæ and of nymphs always more numerous than the adult animals; 4thly, of tegumentary envelopes proceeding from the moulting of a great number of larvæ and nymphs; 5thly, of visceral or muscular remains of the body, of pieces of tracheæ, of striated muscular fasciæ, of dried fragments, sometimes of eggs which have not been laid, and which have become loose in the body of the females of the attacked insects.

In the dust at the bottom of the boxes, amongst the remains of all kinds, antennæ, feet, palpi, broken or fallen, one sometimes finds the envelopes of Gamasus, of Glyciphagus and of Cheyletus,

CASE XIV. Acarids which live also in collections. Upon the insects themselves, and devouring the excrements and the remains of the Tyroglyphus, M. Perris has found, at Mont-de-Marsan, the larvæ of the Cecidomyia entomophila. The walk of the Tyroglyphus entomophagus is slow. It walks with the head bent down, in such a way as to allow the ridge of contact of the two mandibles which go beyond the hairs of the nape of the neck to be seen in front. The males are as numerous as the females and a little more agile.

It remains to say a few words as to the best means of keeping these mites out of collections, and of getting rid of them when they have once effected an entrance. The insects which are most liable to be attacked by the Tyroglyphus entomophagus are, as already said, those which have not been well dried, or which have been placed in ill-fitting boxes in a damp room.

When the Tyroglyphus has attacked an insect, one perceives outside little whitish points on the bodies of those with smooth teguments, or on another kind a sort of greyish white powder mingled in the hairs of cottony or downy kinds. Soon under the insect invaded, or on the corresponding sides of the box, one notices a matter of a greyish pulverulent aspect, recalling the efflorescence of saline matters not deliquescent. This dust is said to be quite different from the organic pulverulent débris which results from the ravages of the Anthrenus or Dermestes; these latter produce a fine sawdust, blackish or brownish, but dry and non-adherent. Collections in the south of France, exposed to damp, are very rapidly attacked by Tyroglyphus entomophagus. The mouldiness which shows itself in a collection makes one suspicious of mites, for mould and mites almost always go together.

When an insect is known to be attacked by Tyroglyphus it is best to isolate it in a very dry box. If the insect is glossy the mites which have got into it should be removed with a fine camel hair brush. If the insect is scarcely attacked, it can be replaced on

CASE XIV.

condition of being watched. But very often one sees reappearing on the body of an insect which has been simply cleaned or brushed, new Tyroglyphi which come from within or from the cavities of the joints where they are apt to gather in large numbers. This shews that the cleansing has been insufficient. One can then have recourse to the heat of the stove or oven. This proceeding is inconvenient when the insect turns out to be what is technically called "greasy." Besides, although the Tyroglyphi may not resist the effect of a high temperature, the eggs often do, especially when they are situated in the interior of the body, and the mites swarm again soon after.

We can scarcely recommend pure water, for if the outside of the dirty insects is washed, it penetrates into the inside, leaving a humidity unfavourable to the object in view.

Alcohol is good for all the insects which can stand its action without being hurt, in their colours, hairs or scales. It will not do for Lepidoptera, but we have often placed beetles that are hard and polished in a flask with a large mouth without taking the trouble of cleaning them. The pin holding the insect is stuck into the under-side of the cork, and the body soaks in alcohol without going to the bottom of the vessel. An immersion of several hours or a day is sufficient. Either simple alcohol, or alcohol containing a small solution of corrosive sublimate, will answer. After a bath of an hour in the latter, the insect should be washed in pure alcohol to carry off the sublimate, which, without this precaution, forms a whitish crust and corrodes the pins. We prefer to use alcohol with arsenic or saturated with strychnine, which, in ridding the insects from the Tyroglyphi, has the advantage of preserving them also against the Anthreni.

Besides alcohol, there are liquids which *scour* the insects perfectly, killing the Acarids and carrying off their favourite aliment. These very useful liquids are ether, benzine, essence of naphtha.

Dr. Leconte has utilized the "atomiser" for thoroughly and imperceptibly besprinkling the insects with such liquids.

CASE XIV. MM. Grenier and Aubé devised an apparatus for exposing the insects without removal to the vapours of such chemicals. It is a large necrentôme of tin, with fastenings, made with a trench to be filled with water, so as to submerge the edge of the cover, and is well adapted for museums and large collections, where the labour of individual cleaning would be too great. But so far as regards mites this is not necessary if the drawers or boxes only fit moderately closely. Then it will be found sufficient to expose a few chrystals of pure naphthaline for an hour or two in the drawers. This is the simplest, easiest, and most effectual of all contrivances to destroy mites.

Where it is necessary to treat the insects in detail, another effective but more troublesome plan is to expose the infected insect to the vapour of liquid ammonia—by placing a morsel of sponge in a paint saucer and moistening it with a few drops of powerful liquid ammonia. The insect is placed on a bit of cork alongside the sponge, and the whole covered by a tumbler or small bell-glass, so as to keep in the vapour; and in ten minutes or a quarter of an hour the cure is generally complete. Sometimes it must be repeated; but this is rarely necessary.

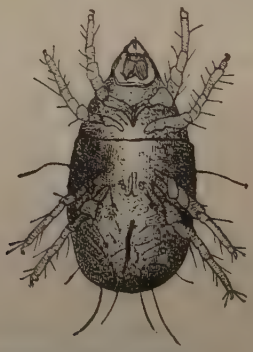
Insects should never be put away until they have been well dried, and, if necessary, freed from fatty visceral matters. This is particularly necessary for kinds brought up in captivity or full of juice at the moment of their capture.

No. 14 TYROGLYPHUS SIRO (*Linn.*, *Latr.*), (Acarus farinæ, *Linn.*; A. lactis, *Linn.*; A. favorum, *Herm.*; T. domesticus, *Gerv.*, haud *De G.*).—**14.** Magnified figure of ditto.

It is usual to hear the flour and the cheese mite spoken of by naturalists, described in books, and mounted by microscopists as two different and distinct species—but they are not so. It was Linnæus who commenced the blunder by judging from the two different kinds of food, instead of from the mites themselves, and describing those which he found on cheese as the Cheese Mite (Acarus siro), those on flour as the flour mite (Acarus farinæ), and

CASE XIV. those in milk as the milk mite (Acarus lactis). It has also received other names. It is the Acarus domesticus of Gervais, but not of De Geer, his domesticus being a Glyciphagus, as is the Acarus destructor of Schrank. The reader will not suppose that we mean that every species found on cheese, or every species found on flour, is this species. There is more than one that feeds on cheese, and doubtless also on flour. All that we mean is that the common cheese mite is found upon flour as well as on cheese, and that the authors above mentioned had made two out of the same species.

Tryoglyphus siro, slightly magnified



Ditto, more highly magnified. Copied from Robins' figure.

It is unnecessary to give any description of the mite. The small figure will give a fair idea of its general aspect, and the larger one will supply the place of a description. As to its habits and mode of life, there is little to add to what every one knows. It lives in almost every kind of cheese when a little decayed, and especially the harder parts. The individuals gather together in winter in groups or heaps in the hollows and chinks of the cheese and there remain motionless. As soon as the temperature rises a little, they gnaw away at the cheese, and reduce it to powder. The powder is composed of similar debris to that mentioned as composing the dust made by the T. entomophagus—excrement having the appearance of little greyish microscopic balls; eggs,

CASE XIV.

old and new, cracked and empty; larvæ, nymphs and perfect mites, cast skins and fragment of cheese, to which must be added numerous spores of microscopic fungi. M. Laboulbène mentions having met with these mites in considerable quantity in some very old linseed meal, that gave forth a very strong ammoniacal odour mixed with that of rotten cheese . . . On different occasions two medical men had sent him and M. Robin for determination specimens of this mite that had been found on wounds that had been dressed with poultices made of linseed meal. On one occasion a specimen had been found in urine. Human nature is apt to prefer the most marvellous way of accounting for such things, but it is the part of science to point out how easily the mites might have found their way to the wound or urine in a perfectly simple and natural way. Professor Robin proved by experiment that it was easy to transfer a colony of this species from a cheese to flour where it throve and flourished. The same means answers to inoculate an uninfected cheese—a few mites transferred from a mitey cheese to an old one not mitey will soon make it as good (or as bad) as the other—only in respect of mites of course.

It is to this species that the following case of dysentery caused by mites has been referred. Rolander, a student of Entomology, while he resided in the house of Linnæus, was attacked by that complaint, which quickly gave way to the usual remedies. Eight days after it returned again, and was as before soon removed. A third time, at the end of the same period, he was seized with it. All the while he had been living like the rest of the family, who had nevertheless escaped. This, of course, occasioned enquiry into the cause of what had happened. Linnæus, aware that Bartholemy had attributed the dysentery to *insects* which he professed to have seen, recommended it to his pupil to examine his fæces. Rolander, following this advice, discovered in them innumerable animalcules, which upon close examination proved to be mites. It was next a question how he alone came to be singled out by them; and thus he accounted for

CASE XIV.

it. It was his habit not to drink at his meals; but in the night, growing thirsty, he often sipped some liquid out of a vessel made of juniper wood. Inspecting this very narrowly, he observed in the chinks between the ribs a white line, which, when viewed under a lens, he found to consist of innumerable mites, precisely the same with those that he had voided. Various experiments were tried with them, and a preparation of rhubarb was found to destroy them most effectually. He afterwards discovered them in vessels containing acids, and often under the bung of casks. In the instance here recorded, the dysentery or diarrhœa was thus apparently produced by a species of mite, which Linnæus thence called Acarus dysenteriæ.

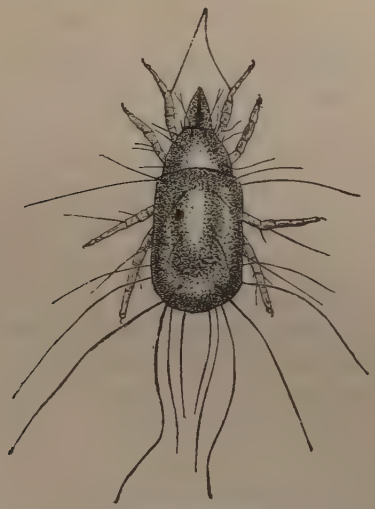
Latreille thought it might be the cheese mite, or one of its allies. It is against the probability of its being so that no recorded instance of this or any other mischief from cheese mites has ever been recorded, although they are daily eaten in quantities too great and too carelessly to leave a doubt that hundreds of living individuals must be swallowed which escape the grinding of our molars. If they did any harm there should be thousands of cases of suffering from them in our medical works, but there is none.

No. 15. TYROGLYPHUS LONGIOR (*Gervais*, in Walckenaer's Apter. iii. 1844), (Acarus dimidiatus, *Herm.*; Acarus horridus, *Turpin*; Acarus Crossi, of English writers).—**15.** Magnified sketch of ditto, copied from Robin's figures.

Very easily distinguished from T. siro (with which it associates), by its more rapid movements, larger size, longer and more cylindric body, and longer and more shining hairs sticking out on every side. Its habits, however, are very much the same, although T. longior does not quite adopt all the partialities of T. siro. It lives upon old and decaying cheese along with it, but not equally on all; for instance, MM. Fumouse and Robin mention that only one per cent. was found by them to belong to

CASE XIV.

this species on Septmoncel cheese; eight or ten per cent. on Roquefort, and somewhat more on Gruyère. MM. Laboulbène



Tyroglyphus longior.
Copied from Fumouse and Robin's figure.

and Robin tried the experiment of placing some of this species along with T. siro, taken from Roquefort cheese, on flour in a state of putrefaction, but the T. longior did not take to it or multiply as T. siro did, but all died in the course of a day or two; a circumstance the more to be noted that they can fast with ease. M. Fumouse kept them for more than a month without food, and they were as lively at the end as at the beginning of their fast. This is the species that is most commonly met with in stores of Cantharides, which are very subject to the attacks of mites (T. siro among others). M. Fumouse has followed the development of this species. In order to observe them, he placed a certain number of individuals with small portions of Cantharides between two plates of glass, separated the one from the other by a circular band of cardboard. He had thus a small glass cage, whose trans-

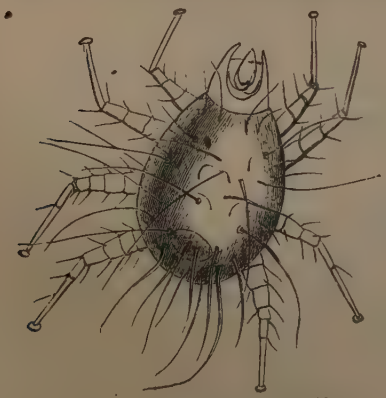
CASE XIV.

parency permitted him to study the life of his little captives under the microscope. The females laid eggs (regularly oval) from the very commencement. The eggs hatched in ten or fifteen days, splitting longitudinally. When the young mite came out, it was hexapod. They cast their skin several times, and it is after the first or second change that they get their additional pair of legs. The skin splits behind, and they come out of the old skin creeping backwards. It is usually considered that they are mature and full-grown when they have got eight legs; but in speaking of other mites we have already explained that this is only partially true. They cannot be called adult until they are provided with complete sexual organs, and this does not take place until later. At first no sexual distinction is visible.

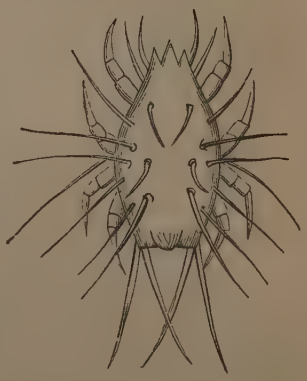
This is the species that gave rise to a good deal of talk among scientific people some forty years ago, as having been supposed to be produced by electricity. It may be remembered that in the beginning of the present century, there was a sort of vague idea in the scientific or semi-scientific world in favour of electricity being the source of many of the phenomena of life. The limits and extent of its power were of course even less known than at present, and all sorts of wild experiments were tried in the search after truth. One gentleman set up lines of electrical wires over portions of his estate, with the view of ascertaining whether the plants would not thrive better under what he supposed would be an increased flow of electricity. Others tried similar experiments in different directions, and among them two gentlemen, Messrs. Cross and Weekes, set themselves to ascertain whether by the continuous use of electrical apparatus they could not produce organic beings, either plants or animals. Mr. Cross's process was to operate on volcanic stone kept moist by a weak solution of silicate of potash, super-saturated with muriatic acid, constantly subjected to electricity. After carrying on this for a time, he at last found some mites wandering about his apparatus or chemical solutions, and arrived at the conclusion that they had been produced by his electrical

CASE XIV.

batteries. The present was one of the species so dignified, and it for some time enjoyed an ephemeral fame as a human creation. It was sent to M. Turpin in Paris (then one of the experts in knowledge of Acari), and, notwithstanding that he had only a single dead specimen in spirits to work from, he (erroneously as it afterwards turned out) determined it to be new, and described and figured it under the name of Acarus horridus (Comptes Rendus, 1837). But although he considered it to be new, he by no means endorsed the idea that it was created by Mr. Cross, or his electrical apparatus. It was not only a highly organised animal, and nearly allied to well-known species, but it proved to be a female containing eggs, which, as he dryly remarked, seemed an unnecessary complication in a new creation. Turpin's figure was not a very good one, as the reader will see from the copy of it that we give. It bore to be a fac-simile, and the specimen having been



Copy of Turpin's figure of Acarus horridus, found by Mr. Cross.



Acarus, found by Mr. Weekes. Copied from figure in Smee's work on Instinct.

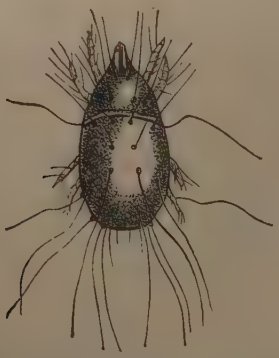
put out of shape by immersion in spirits, it appeared distorted and uncharacteristic. Gervais afterwards, misled by the length and strength of the hairs figured on its body, did not discern that it was actually a species described by himself (the present), but took it to be a Glyciphagus, although there was no trace of the

CASE XIV.

feathered hairs or the other essential and very distinctive characters of that genus. Gervais no doubt supposed that these must merely have escaped Turpin's notice; but Professor Robin has authoritatively settled all dispute about it. He says, "The Acarus horridus of Turpin is only a female of Tyroglyphus longior, Gerv., badly described, and imperfectly figured from want of sufficiently precise taxinomic notions upon these articulates. The tarsus, for instance, is represented and described as composed of two articles, because on account of its length, the little support that is provided for one of the hairs starting about its middle has been divided in two by the draughtsman."

Mr. Weekes believed that he had made a similar discovery, and his mite has been figured too, but still more unsatisfactorily. We give a copy of it also.

TYROGLYPHUS SICULUS (*Fum.* & *Rob.*, Journ. Anat. Phys., 1867).



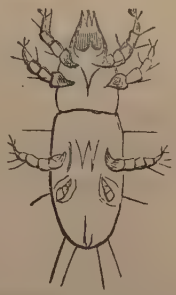
Tyroglyphus siculus. Copied from Fumouze and Robin's figure.

The only remaining European species of Tyroglyphus as yet described is this one named T. siculus, by MM. Fumouze and Robin, which was found in great abundance in Cantharides in Sicily, and is distinguished from the preceding by, inter alia, the shortness of its legs, the greater comparative breadth of its body, and its squat form.

CASE XIV. No. 16. TYROGLYPHUS MALUS (*Shimer*, from Riley's 5th Missouri Report, 1873, 87).

16. Magnified sketch of ditto, from Riley's figure.

Tyroglyphus malus, side view. Copied from Riley's figure.



Ditto, under side. Copied from ditto.

A North American species, said to have been useful in some places (Georgia) in clearing away the mussel-shell Bark louse (*Mytilaspis pomicorticis* of American authors) from the bark of apple trees. From the figure it appears to be narrower and more elongate than any of our species. There is no doubt, however, as to the genus to which it belongs; the smooth body, transverse line dividing it, the tarsal claw, &c., all sufficiently indicate it to be either a Tyroglyphus, or a Rhizoglyphus. Mr. Riley's beautiful figure is not on a sufficiently large scale to allow us to make out which.

TYROGLYPHUS TRANSLUCENS (Acarus translucens, *Nietner;* Enemies of the coffee tree, 1861).

It appears that other mites with similar beneficial tendencies are found in other parts of the world. M. Nietner mentions one under the name Acarus translucens, as preying on the cocci that infest the coffee plants in Ceylon, and his notice would seem to indicate that this is most probably its proper place. He says it is a very minute whitish translucent mite, that is mixed up with the scale insects, and no doubt injures them. On examining old full-grown scale insects, the shells were often found to be filled, not with eggs, but with a white flakey substance, among which the above mentioned mite moved about.

CASE XIV. Genus GLYCIPHAGUS, Hering, Kratz-Milben in Nov. Act. Cuv. (1838), XVIII. a. 575.

A genus, established by Hering, for a mite allied to Tyroglyphus which he found feeding on the sugar of dried fruits, such as figs, prunes, cherries, &c. It derives its name from γλυκος, sweet, and φαγω, I eat. Without going into minute details, its chief characters are a pointed snout (chelate mandibles), a dorsal depression instead of a distinct transverse line, dividing the body between thorax and abdomen, a number, not all, of the hairs on the back long and feathered, particularly behind, and the body terminated by a short button or anal projection at least in the female, a character which occurs in no other type of mites. The legs are five-jointed, and the tarsi terminate in a sucker and very fine almost undecipherable claw, so that they generally look as if provided with simple suckers like the Sarcoptidæ. The skin is neither striate, as in the Sarcoptidæ, nor smooth and shining as in the Tyroglyphi, but has a sort of granular texture that makes it look velvety. The males are greatly rarer than the females. This is a very easy genus to diagnose. It may seem a very trifling matter whether the hairs of an almost invisible

Mouth of Glyciphagus spinipes.

Hair of Glyciphagus.

Claw of Glyciphagus spinipes.

CASE XIV. mite are smooth like bristles, or feathered, or downy, but it is nevertheless a most reliable character, as is the little terminal projection at the tail and the velvety skin. Sometimes the one or the other may be in a position where they cannot be seen, but two out of the three present and the third doubtful is generally sufficient warrant to say that the bearer is a Glyciphagus. If seen in life they are at once known by the rapidity of their movements, they run; the Tyroglyphi walk or creep. The hairs are a most extraordinary part of their structure, for it is not only in downy hairs that the deviation from normal hairs shows itself, but in the most wonderful feathered and flat pennate transparent spatula-like plumes with a transparent membrane uniting the side and midribs. These different types of hair structure enable the genus to be separated into two sufficiently marked sections, the one having long downy hairs and very swift in their motion, the other short feathered or membranous pennate plates, and comparatively slow in their motions. At least two of each are well described; but there are also a number more of the first section which have been less satisfactorily described although they may be good species.

Section I.

Body somewhat elongate, and with long downy hairs.

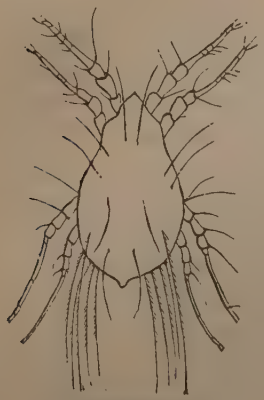
No. 17. Glyciphagus prunorum (*Hering*, Nov. Act. xviii.).—**17.** Enlarged sketch of ditto, copied from Hering's figure.

Hering's description and figure is not sufficiently minute in its details to allow us to be sure of his species, but as it was the first described, and if we were sure about it, ought to be its type, we have placed a copy of it in the case.

Found by Hering in dried plums preserved in sugar. The sugar merchants and grocers in this country are sometimes

CASE XIV. troubled with swarms of either this or some other species of Glyciphagus in their stores of sugar. These mites wander to the hands of shopmen and those that handle the sugar, who suffer considerable annoyance from their presence, which causes a temporary inflammation or irritation known as the grocer's itch.

No. 18. GLYCIPHAGUS CURSOR (*Gerv.*, Ann. Sc. Nat. ; Acarus domesticus, *De Geer*).
18. Magnified sketch of ditto, copied from Gervais' figure.



Glyciphagus cursor.

This species has been found by M. Fumouze, in numbers, in a parcel of Cantharides in company with species of Tyroglyphi (entomophagus and longior) ; Gervais found it among the feathers of dead birds and in the bodies of insects in collections. It is also found on the earth and dust of cellars, and especially in the moulds which grow there.

We have said above that the Acarus domesticus of De Geer was different from the Acarus domesticus of Gervais, the latter being the same as Tyroglyphus Siro. The former is considered by M. Fumouze and Robin to belong either to this species or to Tyroglyphus longior, but they give the preference to this or to some allied form of Glyciphagus. Signor Moriggia (Atti. Acad. Sci. Torino I. p. 449, 1867) mentions a case which would seem to support their view, for none of the Tyroglyphi have been found parasitic, although some of the Glyciphagi have. He figures a singular horny excrescence of great length growing from the hand of a lady, and containing in its cavities great quantities of what he calls "Acarus domesticus." The excrescence was nearly eight inches in length, tapering upwards from a wide base and curved towards the wrist.

CASE XIV. No. 19. GLYCIPHAGUS HIPPOPODOS (*Hering*, Nov. Act. 1838).—19. Magnified sketch of ditto, copied from Hering's figure.

Hering, who described this species, and who, so far as we know, is the only author who has met with it, placed it among the Sarcoptidæ, but although the habitat where it was found makes it not unnatural that he should have done so, there can be no doubt that its characters are all those of a Glyciphagus. It was obtained by Hering from a horse, whose hind feet had for several months had itch mites to such a degree, that although young and in other respects sound, it was so useless that it had to be killed. Both the hind hoofs were quite disorganised, the frog and the sole consisting of a soft fibrous mass, in the wrinkles of which a stinking liquid was secreted. The cracks in the hoof arose from the destruction of the edges of the hoof which became separated and soft, and the animal became unable to go on hard ground. In the end the sore spread at the back from the ball to the flexors and muscle of the fetlock. In the lifetime of the animal very few mites were perceived, but when it was dead, the hoof, in order that its abnormal form might be modelled, was covered with plaster both outside and inside to the frog, and then they were found to be in numbers. They had, as is usual after the death of the harbouring animal, left their retreats and congregated to the edge of the sore and the hardened hide. Although at this time the temperature was several times below the freezing point (in the night it fell to 10 R.); still after several weeks living mites were found. It appears that the cold hindered a further decomposition in the soft parts, and therefore the mites continued to live on in their wonted element.

Glyciphagus hippopodos.

GLYCIPHAGUS BUSKI (see Cooper and Busk's Microscopic Journal, 1842).

It is probably here that an unnamed species made known by

CASE XIV. Prof. Busk ought to come in, which we have taken the liberty to nominate after that eminent naturalist.

It was found beneath the cuticle of the sole of the foot of a negro, who had been admitted into the Seaman's Hospital Ship on the Thames, in 1841, with large sores of a very peculiar character, and confined to the soles of the feet. On examining the secretion of these sores the insect in question was found, but dead, and partially crushed or broken, as represented in the woodcut. It appeared that the disease was caused by its burrowing immediately beneath the thick cuticle, which thus became irregularly detached, being, as it were, undermined by galleries branching in all directions. The disease was attributed to the wearing of a pair of shoes which had been lent to another negro, whose feet had been similarly affected for nearly a year, and who wore the shoes thus lent for a day or two. The negro under Mr. Busk's care was a native of, and came from the West Indies, and was not aware that a disease like his was ever known to occur there, but the negro to whom he had lent the shoes came from Sierra Leone; and Mr. Busk stated in conjunction with this, the remarkable fact that in some water brought by Dr. Stanger from the river Sinoe on the coast of Africa, one nearly perfect specimen, and fragments of others very similar, if not of this identical Acarus were found, rendering it, as he thought, probable that the first man contracted the disease under which he had laboured so long from some external source. Mr. Busk thought it not a very unlikely explanation that the insect might eventually prove to be the parasite of some aquatic bird, or other animal frequenting watery places; and he adds as pertinent to the subject, that he had been informed by Staff Assistant Surgeon,

Glyciphagus Buski.
Copied from Prof. Busk's figure.

CASE XIV. P. D. Murray, that at Sierra Leone there is a native pustular disease called *craw-craw*, which is a species of itch breaking into open sores, and very troublesome to cure.

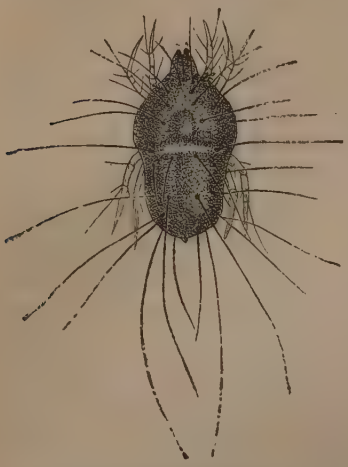
Notwithstanding the imperfection of the materials we cannot feel much doubt that this is a Glyciphagus. It undoubtedly belongs either to the Tyroglyphidæ or the Sarcoptidæ. There is nothing else with which it has even a suspicion of affinity. We cannot place it among the Sarcoptidæ, the striated skin being absent, and the legs made on the principle of the Tyroglyphidæ. But the presence of the posterior button, so characteristic of the Glyciphidæ, seems to us conclusive. So far too as one can judge from Mr. Busk's lithographic drawing, which seems uncommonly good, its skin has a velvety structure. In a dead, crushed specimen we should not expect to see the suckers of the tarsi. There remains only the hair on the body to complete the evidence: if they were feathered, there could not be a doubt remaining; but they are not so figured. We do not, however, regard this as conclusive against the other probabilities. It was only in 1838 that Hering drew attention to this character, and it would not be very surprising if in 1841 and 1842, when there were, no doubt, very few students of Acarids in England, its value or existence should not be generally known there—and if not known it would be very apt to be overlooked by observers and draftsmen who had paid no special attention to the subject.

No. 20. GLYCIPHAGUS SPINIPES (*Fum. & Rob.*, Journ. Anat. & Phys. 1867).—**20.** Magnified sketch of ditto, copied from Fum. & Robin's figure.

Easily distinguished from G. cursor by its smaller size, more conoid form when in life, and by the comparative shortness of its anal appendage; males and females are nearly equal in size. Its legs are longer, owing to the length of the tarsi, and its hairs are considerably larger and more feathery. It moves with extreme velocity, carrying one or two of its posterior hairs on each side

CASE XIV.

crosswise, and drawing the rest after its body. In the length of its hairs and the similarity in size of males and females, it represents in this the Tyroglyphus longior in its genus. Found among Cantharides from Trieste, in company with Tyroglyphi.

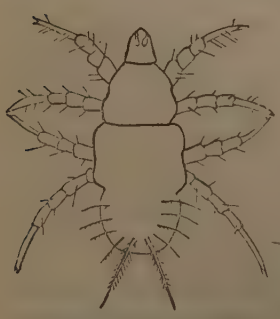


Glyciphagus spinipes.
Copied from Fumouze and Robin's figure.

There only remains one other Glyciphagus of this section still to notice, which is remarkable for the peculiarity of its habitat.

GLYCIPHAGUS BALÆNARUM, Acaridina balænarum, (*Van Bened.*, Bull. Acad. Brux. 1870).

M. Van Beneden, in a paper on the cetacea and their parasites, (loc. cit.) mentions that several individuals of this species were found on a Southern Right whale (*Balæna Australis*), among the cirripeds that incrusted it. He describes it as having the head, thorax, and abdomen, separated from each other, and the body with numerous and long silky hairs, that are plumose. He could not have said in more explicit terms that it was a Glyciphagus; for these, as the reader knows, are its special characters. No anal appendage is represented in his figure, but we know that this only occurs in the females, and the specimen figured by him might be a male, or the posterior termination might not be in a position where it could be seen in the drawing.



Glyciphagus balænarum. Copied from figure by Van Beneden.

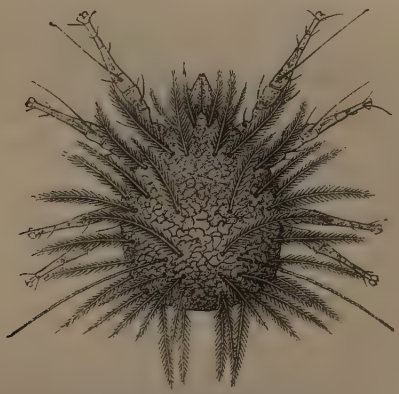
CASE XIV.

SECTION II.

Body short and more granular, with short hairs, either very plumose, or converted into flat pinnæ, with transparent membrane.

No. 21. GLYCIPHAGUS PLUMIGER (*Fum. & Rob.*), (Acarus plumiger, *Koch*).—**21.** Magnified sketch of ditto, copied from M. Fumouze & Robin's figure.

Body pale reddish-white, and flat. The larvæ hexapod. Nymphs octopod, but not sexed; in other respects as in the larvæ. For the special details, we must refer the reader to Messrs. Fumouze and Robin's beautiful memoir on this and the next species in "Robin's Journal of Anatomy and Physiology, 1868."



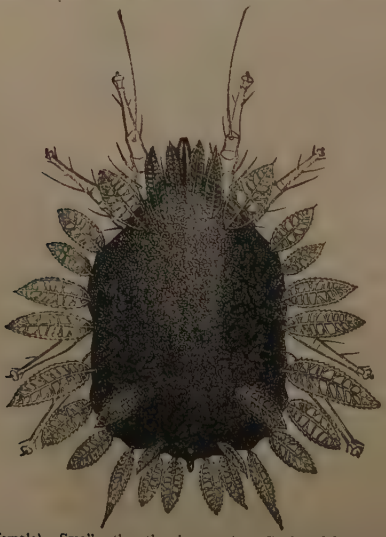
Glyciphagus plumiger. Smaller than the cheese mite. Reduced from Fumouze and Robin's figure.

Found in the soil and moist dust of the walls of cellars, especially in the mouldy parts, also in stables, granaries, and the chaff and dust of fodder. They are easily distinguished from the other Acarids with which they live, by their slower motion, more circular form, by the transparent aureole surrounding their body, caused by their projecting lateral hairs, and by their smaller size. The young Tyroglyphi, Glyciphagus cursor, the Sciri, the Cheyletes, the Gamasi and Uropodes, which are of the same size as them, may be recognised by their more rapid movements, their narrower and more oval body, and by the absence of the aureole just spoken of.

CASE XIV. No. 22.

GLYCIPHAGUS PALMIFER (*Fum. & Rob.*, loc. cit.).—**22.** Magnified sketch of ditto, copied from MM. Fumouze and Robin's figure.

Glyciphagus palmifer (male). Smaller than the cheese-mite. Reduced from Fumouze and Robin's figure.



Glyciphagus palmifer (female). Smaller than the cheese-mite. Reduced from Fumouze and Robin's figure.

CASE XIV.

It is unnecessary to dwell upon or describe this most remarkable mite. The beautifully-executed woodcuts of it by Mr. Whymper, which are scarcely less remarkable in their way than the mites themselves, will give the reader a fair idea of it.

It is more common than the preceding, and found in the same places and associated with it. As both have been found in France and Germany, they may possibly also be found in the southern parts of this country, if properly sought for.

Genus Cheyletus (*Latr.*).

A very remarkable type; distinguished by enormous, rapacious palpi. It is unquestionably carnivorous, its palpi being contrived for holding its prey, while its rostrum is sharp, and well suited for plunging into the body of its victim, whose juices it is to suck up. Apart from the formidable palpi, its general appearance is that of a Tyroglyphus. Its palpi, although so differently shaped, are composed of three joints, like those both of the Tyroglyphidæ and the Sarcoptidæ, but thick and broad as in the latter, instead of small and inconspicuous as in the former. It has a fleshy, semi-transparent body, like the Tyroglyphidæ, but on examination under a powerful glass, it is seen to be not smooth like them, but striated, as the Sarcoptidæ are, only much more finely than them. The legs are five-jointed as in both, and the tarsus has two claws, with a divided smaller claw between them, looking like two. The transparent tarsal sucker, too, is not so visible as in Tyroglyphus, and it wants the conspicuous separate suckers of the Sarcoptidæ. One of its most remarkable features, is the possession of a tracheal breathing apparatus on a plan, which forms a double anastomosing system through the body, and communicates with the air by a joint median stigmatic opening at the symphysis of the two jaws, and by another lateral one on each side at their base, on the outer side, the air probably entering by the middle opening and taking its exit by the lateral ones. This, as well as the whole of the anatomy of Cheyletus and its allies, is beautifully

CASE XIV.

shown in Messrs. Fumouze and Robin's memoir on the subject in the "Journal de l'Anatomie et Physiologie, 1867."

The true position of this genus has been the subject of discussion. Latreille, while placing it in the Gamasidæ, felt inclined to approach it to the Sarcoptidæ; Gervais could not follow him. Koch places it at the end of the Bdellidæ; but it is only in its general predacious structure that it resembles them. The Bdellidæ have long and slender palpi, with five joints; this has them strong and thick with three joints, as in the Sarcoptidæ, and it is to be noted that the genus Myobia has a tracheal respiratory apparatus not unlike that of Cheyletus. To our mind, it has more affinity with the Acaridæ (including Tyroglyphidæ and Sarcoptidæ) than with any other group. It has the surface striæ of the latter; but it has not their suckers, and it has got the facies of Glyciphagus or Tyroglyphus and some of their characters. On the whole we think it will be best to regard it as a transitional type between the two.

No. 23.

Cheyletus eruditus (male). Copied from Fumouze and Robin's figure.

CHEYLETUS ERUDITUS (*Latr.*, Hist. Nat. d. Crust. et d. Insect.), (Ch. casalis, *Koch*; Ch. robertsoni, *Brady*).—23. Magnified sketch of ditto, from figure by Prof. Robin.

These little animals have a characteristic manner of walking, which is neither like that of the cheese mites (Tyroglyphi), nor of the sugar mites (Glyciphagi). When they advance they have not, like them, the head lowered between their first pair of legs; they hold it, on the contrary, directed straight in front, their maxillary palpi being always extended, as if to be ready to seize and embrace any prey they might meet. Then, in place of walking like cheese mites, or running like the sugar

CASE XIV. mites, they advance by making repeated little bounds, which they can execute backwards as well as forwards. They seem to shun the society of their brethren, and when they meet them, they give themselves up to combat, in which their chief aim is to seize one another by their enormous maxillary palpi. These solitary habits are only what one would expect from the possession of such powerful offensive weapons. Whenever an animal has powerful offensive weapons, it lives by rapine, and whoever lives by rapine must be solitary. Any effort at making them gregarious would meet the fate of M. Le Bon's spiders. They were gregarious only until they had all eaten up one another, when the last survivor resumed the solitary life for which he had been intended by nature. Cheyletus forms no exception to the rule. Koch, when he left these animals together between two glasses, observed them seize the cheese mites between their palpi, and plunge their rostrum into their body and suck the soft parts, and Mr. Beck, who has kept them in confinement, and studied their habits, speaks positively to their carnivorous habits, and it would almost appear that they must have something similar to the poisonous powers of the spiders, and that if so a part of the palpi, probably the outer and more formidable of the projecting jaws, in which may be a poison gland, must be equivalent to the falces of the spider. Mr. Beck says that when this Acarus seizes another one of a different kind, which it does by its falces laying hold of a leg or any other part indiscriminately, the prey, after a lapse of about fifteen or twenty seconds, becomes poisoned or paralyzed, the legs bend up under the thorax, and no part of its body makes any resistance to the pulling of the devourer, who, when it finds this passive condition of the prey, deliberately sucks out the fluids with an apparatus at the mouth, and does not leave it until it is entirely empty and shrunken. The poison does not operate, however, when tried on its own species. It frequently feeds upon them, and in that case the prey continues to move and show signs of life so long as any fluids appear to be

CASE XIV.

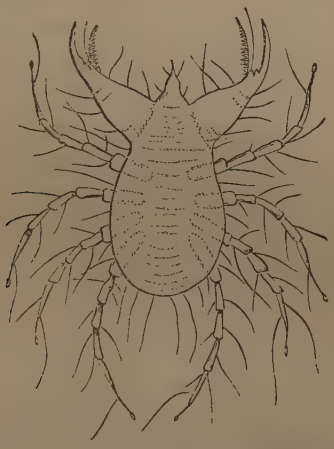
left in the body. They seem pretty generally distributed. They are found in the dust of hay, fodder, and straw, in old chaff, old grain, old meal, old flour and old linseed meal. M. Fumouze met them occasionally in different parcels of Cantharides collected in France. They were very rare in foreign parcels. Prof. Robin mentions that several times specimens have been sent to him, which had been found on the surface of the human body, or in stools, &c., without their having caused any accident. He suggests that they doubtless came from some of the preceding objects, or from the linseed flour used in cataplasms. They are also met with in the feathers and hair of animals preserved in collections, and in insects that have been attacked by Glyciphagi or Tyroglyphi. Mr. Brady also figures a specimen of this species, which he found in his dredgings, and described as C. robertsoni, which had no doubt been blown into them or otherwise introduced from without. We thus see that although in itself solitary, it is met with in all sorts of places, more especially in those where other gregarious Acari most do congregate. But we should no more think that it was there for the purpose of feeding on these vegetable stuffs in which it is found, than we should admit that a cat eats hay, because it was found in the midst of a rat infested-haystack.

Mr. Beck, by keeping this species in confinement, was enabled to ascertain the remarkable fact that the phenomena of Parthenogenesis occur among Acarids as well as in other orders of insects. He began by finding that some broods of other Acarids which he kept in confinement were mysteriously disappearing, and at last traced the mischief to one individual of this species. It proved to be a female, which laid eggs, and from them he reared numerous individuals, which, however, all proved females. Finding that they laid eggs he suspected Parthenogenesis, and tested the fact by isolating a single individual in a glass cage immediately after it had been hatched. It laid eggs, and it ended by his rearing three successive generations from it without any intervention of the male. The female of this species is very careful of her

CASE XIV

eggs. She lays a heap of them, and rests brooding over them, guarding them from attack. The egg shells when empty are very thin, but they reflect a brilliant blue light which attracts the eye more readily than the insect itself, and leads to its discovery in chinks and corners where we might not otherwise detect its presence.

CHEYLETUS MERICOURTI (*Laboulbène*, Ann. Soc. Ent. Fr. 1851. Acaropsis Mericourti. Moq. Tand.).



Cheyletus Mericourti, probably female. Copied from Laboulbène's figure.

M. Laboulbène (loc. cit.) has described this species as very closely allied to the preceding; but the woodcut shows that in the armature of the palpi it differs considerably from it. Three specimens of it were found in the pus which flowed from an abscess in the ear of a naval officer, consequent on an inflammation of the auditory passage. It was near the Bank of Newfoundland that the incident happened, but where the Cheyleti may originally have come from does not appear, nor how they reached their singular destination.

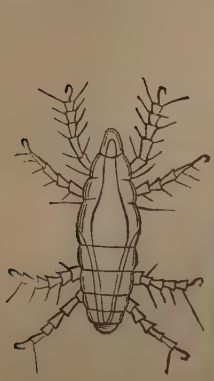
Koch, in his Deutschlands Crustaceen, has described four other species of Cheyletus. Ch. casalis, which he regards as being probably a variety of eruditus, Ch. venustissimus, Ch. hirundinis, and Ch. marginatus.

CASE XIV.

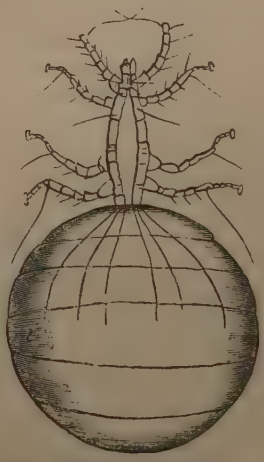
We should now pass to the Sarcoptidæ, but before doing so, we have a form to dispose of, that we have not known very well where to place. Probably it should come in beside Hypopus, but it would have disturbed the sequence we were following, and we bring it in here as an insect *incertæ sedis*.

Nos. 24, 25. HETEROPUS VENTRICOSUS (*Newport*, Linn. Soc. Trans. 1850).—**24.** Magnified sketch of perfect insect newly developed; **25.** Not so much magnified sketch of impregnated female, copied from Newport's figure.

This anomalous-looking insect was found by Mr. Newport, parasitic in the nests of the bee Anthophora retusa, in England.



Heteropus ventricosus mature (either male or unimpregnated female). Copied from Newport's figure.



Heteropus ventricosus, impregnated female. Copied from Newport's figure.

Leg of ditto. Copied from Newport.

The leg, which we also figure, is also puzzling in its affinities. The female with eggs, attains a size four times that of the male, or unimpregnated female. For a full account of its anatomy, we refer the reader to Mr. Newport's paper. It is no doubt the same species, or a similar one, to that alluded to by M. Lichtenstein in Bull. Ann. Soc. Ent. Fr. 1868, under the name of Physogaster larvarum, described as having a vesicular abdomen, and living on larvæ of Hymenoptera.

CASE XV.

Family SARCOPTIDÆ. (Itch and Louse Mites.)

Skin striated; tarsi generally provided with suckers; no eyes.

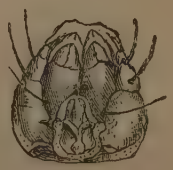
Section I.—Itch Mites infesting the larger Mammals.

Genus Sarcoptes (*Latreille*).

Body flat; shape rounded or quadrate; legs short, not reaching far from the body, supported by chitonous appendages like the garters of an Italian bandit; tarsi provided with suckers; mouth with chelate nippers; but whether four or only two is still *sub judice.*

The accompanying woodcuts show the striated surface of the skin, the bandaged legs, and the suckers on the feet and chelate nippers, described under the generic characters, and admirably adapted for nipping and mining away the skin, through which they make their galleries. It is a similar adaptation of structure to purpose that they are eyeless; their life being, as it were, subterranean, they need no eyesight, and therefore are provided with none.

Anterior leg and sucker of Sarcoptes scabiei. Reduced from Furstenberg's figure.



Mouth of Sarcoptes scabiei. Ditto.

The above figures are taken from Furstenberg's admirable drawings. There is only one point on which some doubt as to their accuracy may be said to rest, viz., the four nippers. Claparède assumes that these must be all mandibles, which is double the number of mandibles found in any other known articulate, and is surprised that Furstenberg should not have been startled by this anomaly; and he casts about to find some explanation by which

CASE XV. to reconcile it with the general accuracy of Furstenberg's representations. He thinks he may have been misled by having made his observation by crushing some individual that was about to cast its skin, so that he saw both the mandibles in the old skin and in the new; and, having once determined the fact, of course it would not be necessary that he should trace it in every individual or species that he figured of the genus. In all, young and old, and of every species, he certainly represents the four nippers as present. The light in which we felt disposed to regard them was, that although all four are alike, one pair represents the mandibles and the other the maxillæ, of which there is no other trace. On the other hand, in both the genera, Symbiotes and Psoroptes, Furstenberg figures only one pair of mandibles as present (chelate in the one and divided in the other), and no trace of maxillæ; consequently we think it best to reserve our judgment, merely noting the point as one deserving the examination of some of our good microscopists.

Nos. 1, 2, 3, 4. SARCOPTES SCABIEI (*Latr.*).—**1.** Two eggs of ditto, one closed and one opened, to show the embryo within, ready to be hatched; **2.** Magnified diagram of the burrow in the human skin, with the insect at the further end, and the gallery encumbered with eggs and broken egg shells, débris, &c.; **3.** Magnified sketch of male—upper side; **4.** Magnified sketch of female—under side. Copied from figures by Furstenberg.

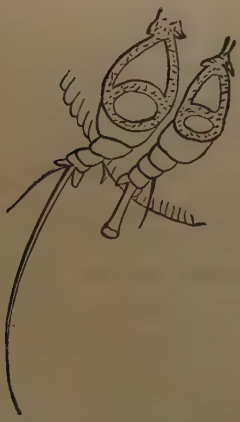
Sarcoptes scabiei, male. The itch mite.

Ditto female. Reduced from Furstenberg

CASE XV.

The specific characters are chiefly drawn from the bristles and hooks on the tarsi, the number of short stumpy thorns or spines on the back, and the proportions of the different chitonous bands and other parts. This species, for example, has six thorns on the back of the thorax, and fourteen on the back of the abdomen. These have some resemblance to a short Roman sword. There are also a great number of smaller papillæ or raised projections, the form and disposition of which are used as subsidiary characters.

When examined with the naked eye, the mite looks white and shining, and was aptly described by Bonomo, one of its first observers, as like a little bladder of water; when seen running, however, upon the surface of a plate of glass, it may be perceived that its anterior margin presents a dusky tint of colour, and the examination of this part of the creature with the microscope brings into view a head not unlike that of a tortoise, and a pair of large and strong legs on each side of the head. These organs are more or less encased in a moderately thick layer of chytine, and have consequently the reddish-brown tint of the cases of certain insects, or of the bright part of a thin layer of tortoise-shell.



Two of the posterior legs of the male of Sarcoptes scabiei. Copied from Furstenberg.

Two of the posterior legs of the female of Sarcoptes scabiei. Ditto.

CASE XV.

The most apparent difference between the male and the female is, the smaller size of the former, and the different formation of the two posterior pairs of legs. In the male, the third pair are terminated by a long bristle, and the fourth by a pediculated sucker, whereas, in the female, both third and fourth pairs are terminated by a long bristle. On the under side of the male, moreover, there is a complicated series of chitonous bands, which are not present in the female. When newly hatched, the young Sarcoptes has only three pairs of feet, and the hind pair terminates in a long bristle; the complicated chitonous bands have not yet appeared.

Burrow of itch mite in human skin with mite at further end. Copied from Furstenberg.

The insect lives in the human skin in little tunnels eaten away by itself. The female, as she works her way, lays her eggs behind her, as may be seen in the accompanying illustration, copied from Furstenberg's work on Itch Mites. We do not know how many she can lay, nor do we well see how that could be ascertained; but it is said that she lays some every day, and that she may lay as many as fifty. Neither do we see how it can be found out how long they take to hatch, but again it is said, from seventy hours to six days. If Furstenberg's illustration may be depended on, which shows a considerable number of empty egg-shells dropped irregularly all along the burrow, and only one unhatched close to the mite, we should imagine that the shorter period was the most probable.

The mite changes its skin four times before it attains

CASE XV. maturity, and it is a few days after one of these changes that it obtains its additional posterior pair of legs. This pest was formerly much commoner than it is now. Soap and water, or their synonym cleanlier habits, have rendered it comparatively scarce, but whenever numerous bodies of men are crowded together without time and opportunity to attend to their personal cleanliness, then it reappears and spreads like wild-fire. All armies are great sufferers from this and louse vermin. The Americans found it so prevalent during their wars, that the common people supposed it was something special and peculiar. "The army itch," "the seven years' itch," "the Jackson itch," are all only the common itch developed by the special circum stances of the case into a peculiarly flourishing condition.

Our great English authority on skin diseases, Dr. Erasmus Wilson, gives the following as the indications of an attack by this insect, viz., firstly, a peculiar scaliness and undermined state of the epidermis, which is not met with in other cutaneous affections; secondly, the presence of conical vesicles, with acuminated and transparent points; and thirdly, and principally, the presence of the mite itself, which may be extracted from its retreat beneath the loosened epidermis with the point of any sharp instrument. The diseases which he mentions as apt to be confounded with it, are eczema, prurigo, lichen, impetigo, and ecthyma.

When one of the early vesicles of the itch is examined with attention, a minute spot or streak may be observed upon some one point of its surface. This is the aperture originally made by the insect on its first entrance within the epidermis, and from this spot or streak a whitish fluted line may be traced, either in a straight or a curved direction into the neighbouring epidermis.

The whitish line is the cuniculus, or burrow of the acarus; and the fluted or dotted appearance is due to the eggs, the white dots indicating the points where the eggs lie. The burrow necessarily

CASE XIV

varies in length, being sometimes as much as five or six lines in extent, and at its termination, under a slight elevation of the skin, the little inhabitant lies concealed. The mite may be easily distinguished by the experienced eye, as a small dark point at the end of the burrow, and if a thin capsule of skin be raised in this situation with the point of a needle, the little creature is brought into view.

The spot or streak, which is here described, is not met with on all the vesicles, for the same animal may excite a series of these in its course; and a number may be developed in the vicinity of its habitation, while it is in the primitive vesicle alone—that formed by the entrance of the mite—that the trace of its entrance can be expected. The aperture again, does not communicate with the interior of the vesicle; it is the too close neighbourhood of the little grubber that acts as the cause of the formation of the vesicle; the vesicle is consequently a provision of nature to protect the inner skin from the nearer approach of the cause of irritation.

The itch mite, therefore, is never situated within the vesicle, or within the pustules, and there is no communication between the vesicle and the burrow.

There is no difficulty in extracting the mite from the skin; the burrow is seen without difficulty; the end of the burrow is perceived to be a little raised, while a greyish speck is seen beneath it. As soon as this little eminence of skin is lifted, if the end of the needle or pin with which the operation is performed be examined, the minute, white and shining globe will probably be observed attached to the instrument. If there be no such object, the point of the needle placed again beneath the raised capsule of epidermis will pretty certainly draw it forth. This facility of extracting the little creature is due to its great power of clinging by its suckers to any object with which it comes in contact.

The proximate cause of the appearance of itch is of course the presence of this mite, which is transferred by the infected to those

CASE XV. who are sound by actual contact. In some instances, it may be conveyed to the person in its adult state; while in others, ova, or embryos suspended in the fluid of the vesicles, may be the mode of transmission. Certain it is, that the application of one of the mites to the skin of a sound person will give rise to the disease. The precise mode of its transmission, however, was for a time a puzzle. Its contagious nature could not be disputed, but it was remarked with surprise that infection among doctors and hospital attendants was comparatively rare. Dr. Aubé set himself to find out the cause of this, and he learned from a great number of inquiries at patients as to the manner in which they had contracted the disease, that it was almost always by having slept in the same bed with an infected person. He found that the number of those who had so contracted it was to those who had acquired it by manual contact as 100 to 5. Dr. Aubé inferred from this, that the mite was a nocturnal animal, and his other observations and an experiment made upon himself confirmed this view. The animal hides under the skin during the day, but walks about at night, perhaps excited by the greater warmth of the body in bed, and pricks the skin in various places. This explains the rarity of contagion during the day and the small number of burrows that may be remarked on the skin even where there are a great number of pustules, and also why the violent itching only occurs during the night. In confirmation of what we have said, we may quote the statement (Amer. Ent. ii. 118) that in the great hospital at Vienna, 1500 cases are treated yearly, and no attempt at disinfecting the clothing is found necessary. The under clothing should be washed thoroughly, but outside garments, contrary to the general opinion, do not need anything to be done to them.

The best mode of treatment for getting rid of the parasite is very simple. So long as it was supposed to be some mysterious disease whose cause was unknown, it was not to be expected that it could be successfully treated, but now that we know all the

CASE XV. particulars above related, its treatment is as clear as day. It is produced by an insect, and all that we have to do is to kill it. But what will kill it without hurting the patient or rather the impatient, especially when the skin is almost scratched through to the raw flesh beneath? Fortunately we know one substance that seems to be almost invariably poison to insects in whatever shape it be given—sulphur. You can get rid of the green fly; you can banish the scale; you can free your kitchen from cockroaches; you can extirpate almost every insect pest by the use of sulphur. The form in which it is administered does not seem to matter much. It may be powdered dry over the leaves as when we attack the red spider or green fly. It may be administered in smoke, it may be given in solution, it may be mixed up into a soap like Gishurst Compound and various other similar preparations, or it may be administered in an ointment as in the case of the itch, and in all it is alike effectual. It is only necessary to get at the insect so as to expose it to its influence and the insect dies; and surely if there ever was a case in which it was easy to put salt on a bird's tail, it must be where the creature is in a tunnel that you can trace, and where there is neither opportunity nor temptation for it to come out and move off. There is no doubt a little difficulty in getting at it, for the tunnel in which it is lodged is sinuous and too small for injection or infiltration and up which the sulphur, in whatever form administered, must have difficulty in penetrating; but if we cannot reach it through the tunnel, we can, by removing the surface of the skin so that nothing but a thin permeable roof lies between our application and the mite. By bathing and steeping the parts affected in hot water or vapour, and then rubbing off the skin as much as possible, the Sarcoptes is laid sufficiently bare to allow the sulphur to act through the skin upon it. But although it may be killed, the eggs may not, and that explains how one application is rarely sufficient; but never mind, after a day or two's pause, during which any surviving eggs may be hatched, let the process be repeated. The newly-hatched insects will thus be

CASE XV. killed before they have had time to begin to lay eggs, and as soon as the old crop of eggs is exhausted the cure is complete.

It is not alone on man that this species establishes itself. It has been found on the lion, on the dog, the lama, the sheep, the ox, the horse, and the sow, and although it is very possible that some of the observations on which this statement is made are erroneous, and that some allied species peculiar to the animals in question may have been mistaken for the S. scabiei, still there is no reason to doubt that it is the species which is most universally distributed, and which is found on the greatest number of mammals. We hear of old mangey lions in a wild state, but it is most probable that it is only in captivity that they are really attacked by the itch, which no doubt they owe to the dirty attendants that wait upon them. They succumb rapidly to its attacks, dying in a few months, and become miserable objects before they die. The head is the part chiefly attacked. It becomes covered with a thick crust, the nostrils closed, the skin of the head and neck swollen into hard folds, and the whole animal in the last stage of debility.

There remains one point for consideration regarding these mites, not less curious than any of the preceding, viz. :—How they produce the physiological effects that characterize the malady. It is a problem that will often recur to us as we go along through the other classes of insects. We shall find the larva of one kind of insect feeding in some part of a plant without giving rise to any symptoms that can be called inflammatory or envenomed, while others of the same size, of a different kind, feeding alongside of them produce immense growths or galls. In speculating upon the cause of the itching sensation and inflammatory symptoms of the skin in attacks of the Sarcoptidæ, the first and most natural supposition is that they are caused by the incessant minute nibbling going on just at the termination of the smallest ramifications of the sentient nerves terminating in the skin. Undoubtedly a constant gnawing of this kind must not only produce irritation,

CASE XV. but irritation of a kind quite different from any less continuous and minute shaving. But then we have different symptoms produced by different species; the scurfy inflamed surface of the S. scabiei; the coarse leprous crust of the S. scabiei-crustosæ; the deep ulcers of Glyciphagus hippodos; and so on. It is possible that there may be some difference in the kind and degree of mechanical irritation to produce such different results; but it is also possible that there be some special poisonous or irritant virus in the bite of the different species, to account for the variation in the phenomena observed in each.

There are several other species of itch mite. One of the most formidable (producing a much worse complaint than the common itch) is the following:—

SARCOPTES SCABIEI-CRUSTOSÆ (*Furstenberg* Kratzmilben).—The Norwegian itch mite.

This is very like the common species, but smaller and somewhat darker. It likewise is attached to man, but fortunately is much more rare. It was first described from Christiana in Norway, and seems to be more particularly special to that country, although examples of the disease have occurred in other countries.

It was first noticed by MM. Boeck and Danielssen in Christiana, in their Treatise on the "Spedalskhed," Elephantiasis, &c., published in 1848. Among the diseases of the outer skin they found a kind of tubercles covered with thick brownish crusts, in which they discovered an Acarus, which presented itself in millions, not only on the surface of the tubercles, but even in the softened tubercular mass. When the mass was examined with a lens, it appeared to consist of nothing but small white round points, which, placed under the microscope, proved to be Acari in every stage of development. The tubercular mass consisted of softened tissue, and on the inner surface of the crust an innumerable crowd of the little animalcules appeared. The

CASE XV. crusts are extraordinarily hard, almost like horn, and if they are softened by steeping in water and placed under the microscope, they seem to be composed in some sort only of the skeleton skins of dead mites, superposed and bound together by a viscous matter; in truth, it is a little world of animalcules, one generation upon another, and their skeletons compose this most remarkable form of "Spedalskhed." This description does not accord with the usual work of a Sarcoptes; but Messrs. Boeck and Danielssen seem to have had no doubt on the subject, and only to have had a difficulty in making up their minds whether it was the common S. scabiei or a different species. They inclined to the latter, in which view they were confirmed by the opinion of Norwegian naturalists, to whom they showed specimens and a figure. That figure has been published in their work, but we have not seen it, and only obtained the above knowledge of its contents from M. Furstenberg's account of the literary history of the itch mites given in his valuable work, Die Kratzmilben.

The description, however, quite agrees with that of subsequent observers who have met with the disease. Fuchs describes two cases, and M. Second-Fereol one that he observed in Paris, which place the symptoms in even a worse light than those recorded by M. Boeck.

The complaint, as described by him, was chiefly seated in the hands and fore-arms, and was characterised by crusts of a dirty yellow colour of considerable thickness, especially on the hands, where they formed a stratum that reached, and even exceeded half an inch in thickness. They were traversed by broad and deep cracks, which corresponded more or less with the articular folds. The bottom of these cracks was moist but whitish, and by no means bloody; the fingers and back of the hand covered by this sort of cuirass, looked like the bark of a rugged rifted tree, but of a yellow colour. On the rest of the body it lost, or perhaps it would be more correct to say, had not yet attained, its character of continuous envelope, but it was dispersed over

CASE XV. almost the entire body in patches or spots. The smell was repellant, and the patient suffered from an incessant and extreme itching. Itch mites were found in the crust, but never in the substance of the skin. Two attendants who applied dressings to the patient were attacked, and their symptoms were at first those of the common itch. One was speedily cured by sulphur baths. The other was still under treatment, six weeks after the entrance of the original patient, and symptoms of lichen and prurigo were showing themselves in addition to the regular furrows of the itch.

SARCOPTES VULPIS (*Furst.*).

Obtained from an infected fox in the island of Rugen ; has slight differences of the same nature as in the preceding species.

SARCOPTES CAPRÆ (*Furst.*).

Differs slightly from S. scabiei in the same way as the preceding.

SARCOPTES SQUAMIFERUS (*Furst.*), (S. suis, *Gerl.*, and S. canis, *Gerl.*).

Found on the sow and the dog, still very like the S. scabiei, and with the same number and disposition of hairs and spines, &c.

SARCOPTES CATI (*Hering* and *Gerlach*), (S. cuniculi, *Gerl.*, and S. minor, *Furst.*).—**5.** Magnified sketch of male.

On the cat and the rabbit. The species is a good deal smaller than the Sarcoptes scabiei. The thorns or spines on the back begin to alter; on the thorax they are absent, or turned into hairs, and there are now only twelve thorns on the back of the abdomen.

Both in the cat and the rabbit this parasite takes the head as its point of attack, and more particularly the base of the nose, the lips, the ears, and the eyes. Even when the animal is inoculated elsewhere by putting the mites upon other parts of the body, and after they have actually taken possession and begun to

CASE XV.

burrow, they soon leave these parts and, making for the head, establish themselves about the nose and ears. In its early stage the burrows, when sought for, can be easily seen, but the obstruction, caused by the more numerous hairs, makes them more tortuous and often interrupted. As the mites increase, so do the burrows and the itching, and the cat scratches itself, and tears the skin: then the hairs fall off, and the parts around the eyes, nose, and ears, become covered with hard crusts spread over and adhering to the suffering parts. The time that the mischief takes to reach this stage varies according to the age, strength, and condition of the cat; as a rule, the young and strong resist longer than the old and feeble. In them, by the twentieth or thirtieth day, it may have spread over the head, ears, nose, shoulders, and even the back and the loins. The crust becomes harder and grey and agglutinated to the hairs; and under the crusts specimens of the Sarcoptes may be found. By degrees, as the malady progresses and the animal becomes weaker, the skin increases in thickness, becomes hard, stiff, and forms voluminous folds round the neck. The swelling of the tissues and their inflammation extend to the nostrils, obstruct the respiration, and give the head of the cat that elephantiasian appearance that occurs also in the lion, and is indeed a constant character in cases of itch among feline animals.

When it has completely covered the head, it extends by degrees over the whole body; it is then impossible to describe the miserable condition of the poor animal, which the parasites are devouring as if it were a dead carcass—the feebleness is so great that it totters on its limbs, and can scarcely drag itself along. All its skin is a focus of infection, where crusts and entangled hairs form pieces like hideous shells, and which pieces tear off in plates. It is true that they rarely reach this extreme stage, being usually destroyed before the disease passes through all the stages of complication. Still plenty of dead cats that have had the disease bad enough may be seen in the dust carts and on the

CASE XV. manure heaps of all great towns. The most of them are either killed or die in the cellars of houses where they have taken refuge.

In the country the complaint is much rarer, the opportunity of contagion being so much less; but when it appears there it runs its course as rapidly as in towns. M. Delwart, of Brussels, said, in 1830, that he had seen in large farms, where a great many cats were kept, the malady spread itself with such rapidity that in four or five weeks all the cats had been carried off by the affection; and in 1827 M. Sajous, a veterinary surgeon residing at Tarbes, related that a very intense epizootic itch had raged in that district among the cats for several years, and it proved so murderous that entire villages remained wholly deprived of cats. The malady seems to vary in virulence at different times, and when very bad it is called epizootic, when milder, sporadic: differences which may be due to the character of the season or general robustness of the animals' health at different times.

The symptoms are the same in the rabbit when it is infected.

The same remedies that are used for the itch in man should be used for this variety, and of course modified in their administration to suit the different characters of the patient.

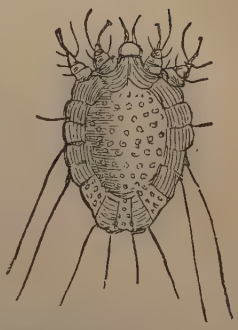
In the country the cats may occasionally in autumn be seen suffering from great irritation, and people are apt to jump to the conclusion that they have got the itch. But it is always easy to tell whether it is so or not, for if the itch it shows itself about the head, nose, and ears, and if instead of that the irritation is about the feet, ten to one it is caused by the harvest mite, Leptus autumnalis, which the cat has caught in wandering about the garden, and usually on examination the matter can be put beyond doubt by finding the little red mite in the fur, or between the claws of the cat. If kept from getting a fresh supply it will soon get better, for the mites will by and bye leave it of their own accord: but if it is allowed to get a fresh supply every day, it will of course get worse and worse as long as the supply is renewed.

CASE XV. SARCOPTES RUPICAPRÆ (*Hering*).

On the chamois.

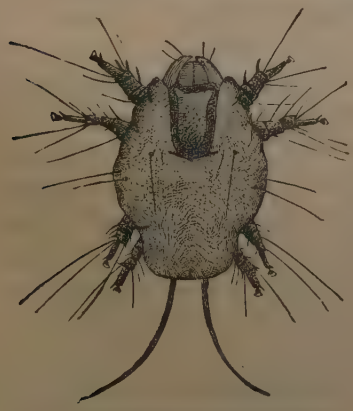
SARCOPTES DROMEDARII (*Gerv.*, Ann. Sc. Nat. 1841).

Procured by M. Gervais in the mangey crusts of a dromedary which had newly arrived at the Jardin des Plantes from Africa. As soon as it was found that it was suffering from the itch it was killed: an extreme measure which would not be thought of now. From the figure given by Gervais, it appears to have been a very well marked species, but belonging to the same genus as S. scabiei.



Sarcoptes dromedarius. Copied from Gervais' figure.

Nos. 6, 7, 8. SARCOPTES MUTANS (*Robin* and *Lanq.*, Comptes-Rendus, xlix. 1859; and Bull. Soc. Imp. Nat. Mosc. xxxiii. 1860).—6. Magnified sketch of male, upper side; 7. Ditto of male, side view; 8. Ditto of female, under side. All taken from M. Robin's figures.



Sarcoptes mutans (male), under side. Reduced from Robin's figure. The joints of the palpi are omitted.

Sarcoptes mutans, female. Reduced from Robin's figure.

This species is a parasite on the domestic fowl. We owe our knowledge of it to MM. Lanquetin Reynal, and Professor Robin.

CASE XV. A full description, with careful figures, will be found in the Bulletin of the Society of Moscow, 1860. It is a very flat, broad species; and the absence of spines on the back at once distinguishes it

Sarcoptes mutans, side view. Copied from Robin.

from all the preceding. The ailment produced by it, is observed most frequently on the hen and the cock, appearing first on the feet, on the comb, and about the beak. No premonitory symptoms indicate its approach. The fowls preserve their appetite and liveliness; although sometimes a careful observer may see that the sick animals shake their heads, raise and stretch their legs in a convulsive manner. If the examination is followed up, some white points and lines traced in zigzag, covered by very small scales, which the least rubbing knocks off, may be seen on the comb. The skin, covered by them, is lightly chagrined and of a brown colour, which contrasts with the red colour of the rest of the comb. At that period no lesion of the tissues is observable. The malady remains stationary for fifteen days or even a month, at the end of which time the base of the comb thickens and becomes darker, and the linear tracings assume the appearance of true burrows of the itch insect, and at the bottom of them the Sarcoptes mutans is to be found. At a later period the feathers of the head and about the beak undergo a remarkable change: they turn back, stand on end,

CASE XV. and lose their brilliancy: they become white and atrophied as if there were some perversion of the secretion of the skin of the bulb. At the point where the feather detaches itself from the skin, there is found a mass of epidermic matter in a bed of the thickness of some millimetres, and all around are lines or burrows formed by the raising of the skin.

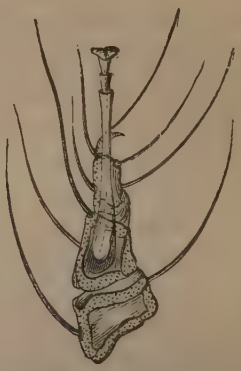
As the malady proceeds, the feathers of the head and upper part of the body become atrophied; their free extremity bends, twists, and rolls upon itself, and ends by disappearing in the midst of the epidermal products accumulated at the base of the quill. The head and neck of the fowl have at that period a very peculiar aspect; they are despoiled of all the feathers that decorate them in their normal state. The comb is brown with a rugged surface, drawn back upon itself, broad at its base and spotted with whitish mealy patches. On various parts crusts, of some lines in thickness, appear, which, when detached, leave a slightly scaly surface, which recalls to mind the disease named phthiriasis. The complaint does not always begin on the head. It sometimes makes its first approaches on the feet. Similar symptoms occur there, but they proceed more slowly, but by-and-by the scales on the feet and legs begin to come off, and a crust forms upon them, more especially between the toes. Sometimes it envelops the whole of the foot and tibia, forming a crust a third of an inch in thickness. Bits as large as a hazel nut, or a walnut, may be broken off. This affection has much analogy with the Norwegian itch above described. It can be communicated both to man and to the horse.

Genus Psoroptes (*Gerv.*). (Dermatodectes, *Gerlach*; Dermatokoptes, *Furst.*)

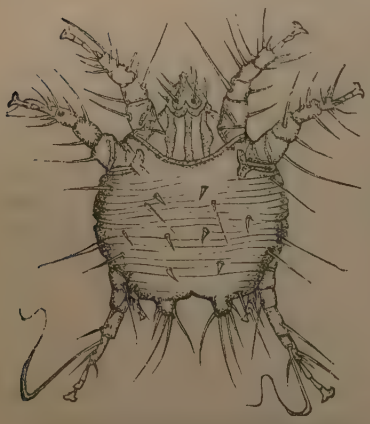
Palpi soldered to the mandibles, of which there is only one pair, which is adapted for piercing and not chelate; stem of the suckers or ambulacra three jointed.

CASE XV. No. 9. PSOROPTES EQUI (*Gerv.*, Ann. Soc. Nat. 1841), the horse and sheep itch insect (Dermatodectes equi, *Gerl.*; Dermatodectes bovis, *Gerl.*; Dermatodectes ovis, *Gerl.*; Dermatokoptes communis, *Furst.*).—**9.** Magnified sketch of male, upper side.

Mandibles of Psoroptes equ
Copied from Furstenberg's figure.



Ditto anterior leg and suckers.
Copied from Furstenberg.



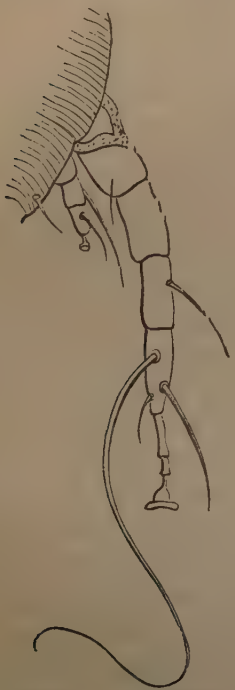
Psoroptes equi. Copied from Furstenberg's figure.
(Striation on body not sufficiently fine.)

Furstenberg shoves aside the old names with rather too much nonchalance. If every one were entitled to change a name merely because he thought he could give it a better or more appropriate one, there would be no end to new names. Or if every time that a specific name was picked off, the generic name that accompanied it must go too, matters would be still worse. It seems a very questionable step to change the specific name equi into communis, merely because the insect has been found on other animals besides the horse; and the substitution of his new generic name (Dermato-

CASE XV.

koptes) for Psoroptes, or Dermatodectes, seems to be altogether without justification, and he offers none.

The genus is easily characterised. It is not a burrowing mite; and, in accordance with its habits, it has lance-like mandibles



Psoroptes equi. Two posterior legs of male.

Psoroptes equi. Two of the posterio legs of mature female.

instead of dentate nippers, and the palpi are soldered on each side of them, so as to make them form a sort of tube. The jointed or telescopic suckers or ambulacra, as they are called, as shown above, also easily distinguish it. The difference in the sexes is of a similar nature to that in Sarcoptes. The above cuts show the difference between the two posterior pairs of legs in the mature male and female. There are other differences in the immature stages.

CASE XV. This species occurs most frequently on the horse and sheep; but it is also found on the ox. It is also said sometimes to stray to man; but this is an error. We read, indeed, in Hering, of two cases where the itch was transferred from diseased horses to men, and others are cited elsewhere; but as the insect was not identified, and the symptoms do not correspond with those produced by the Psoroptes equi, it is most probable that the horse was only suffering from an attack of Sarcoptes scabiei, and communicated it back again to the class from which it received it.

Still the cases are instructive, therefore we quote them. The first case is taken from the Italian journals :—

"In January, 1820, a farmer, Magni, bought a mangy horse at the market in Bergamo (in the province of Mailand), on which he rode home. The morning after his arrival he felt a strong itch over almost the whole body, as also his son and a friend, who had accompanied him from the market. The stable-boy, who had to attend to the horse, scratched himself very much the following day, as well as another who had worked some hours in the field with him. At last more than thirty persons on the farm had the itch, as well as some horses, all directly or indirectly from this horse. Magni sold the animal to a joiner, who was soon attacked; not less so his boy, who had laid his hand on the horse's back, and a cow that had rubbed against the collar and crib of the horse. It is noticeable that all the individuals who were attacked felt the itch in twenty-four or thirty-six hours after coming in contact with it; this is the more remarkable as it was in January. The itch character of the sores is confirmed by credible physicians and surgeons."

The second instance is related by Sydow, and is to the following effect :—

"In the summer of 1808 we had a horse in our Animal Hospital suffering from the so-called Grecian Mange, which is a very obstinate disease, and defies the best medical treatment.

CASE XV. This horse, with the view of seeing the so-called scab mite (Acarus exulcerans), was exposed to the sun. The scab on the hide was loosened with our hands, and we took a magnifying glass to examine the scab with, but saw no scab mites. Then we took some of the scab and laid it on white paper, and searched amongst it again with the magnifying glass without seeing what we wished, but instead, five days after the examination, we had scab pustules on both hands. That we could not have got them in any other way was certain, and a proof was, that five veterinary surgeons besides ourselves were attacked from the same horse."

In both of these cases (the latter more especially, for the itch pustules are mentioned) the mites burrowed in the skin of the horse. The way in which the Psoroptes equi proceeds is quite different. As already said, the mandibles are not adapted for burrowing, but for lancing—and accordingly it makes no burrow. It lays its eggs on the skin to which they adhere by a gluey matter. The mites themselves move about among the hairs, often crowded in great numbers, and they feed by plunging their sharp mandibles deep into the skin, and sucking out its juice, although they do not and cannot penetrate so deep as to pass through the skin or reach the blood. It is thus easy to say whether an itch infection is that of the man or the horse mite. Indeed, from experiments made, the horse mite does not seem capable of establishing itself on man. Specimens have been transplanted on to him, and all that he has felt has been a slight uneasiness from the mites plunging their mandibles into the skin; but that soon passed: the mites went their way and disappeared, and no itch complaint followed.

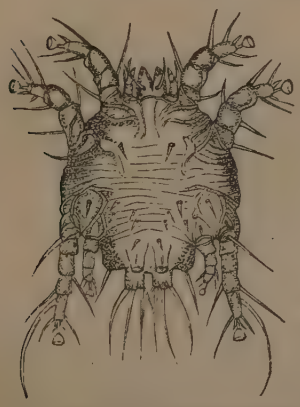
On the sheep it is said by M. Delafond to give rise to the disease called "black muzzle." The sheep attacked has the skin of the face, lips, around the eyes, and the external surface of the ears covered with a great quantity of furrows and mangy papillæ forming thick hard adherent greyish crusts under which the mites live and breed, and the fleece falls off in great flakes.

CASE XV. Genus SYMBIOTES (*Gerlach*), (Chorioptes, *Gervais;* Sarco-dermatodectes, *Delafond* and *Bourg.;* Dermatophagus, *Furst.*).

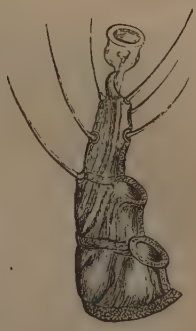
The ground for Furstenberg's cancelling Gerlach's generic name here (Symbiotes) is that there is a genus of beetles previously so named by Redtenbacher. Purists do not allow such duplication of names. The same generic name, they say, should never be twice used in the animal kingdom; but the general world rolls on its way, making language as it goes, introducing this new word, rendering obsolete that old one, corrupting this and modifying that, without regard to critics and grammarians, and they have to accept the language, and words thus altered whether they are vulgar or genteel, grammatical or ungrammatical. So the scientific critics and grammarians may rest assured that they must do the same thing. Names will acquire currency whether they like it or not, and whether they are in accordance with their rules or not, and so long as no confusion is produced, it is right that it should be so. Names are a mere means to an end, and not the end itself. Therefore we say that while we think every author should be careful not to introduce a generic name that has previously been used in some other branch of zoology, yet when by chance a double employment has crept in, it should be allowed to stand, unless it is one that may reasonably be thought likely to produce confusion. A double employment of the same name for a genus of beetles, and for a genus of mites can hardly be expected to do so, and therefore we retain the name Symbiotes, inadvertently used by Gerlach, in preference to the new Dermatophagus proposed to be substituted for it by Furstenberg. The mandibles are made on the same principle as those of the itch mite of man (Sarcoptes scabiei), being chelate nippers, with which it snips its way through the skin, and, having made a raw, lives under the scabs or crusts that the serosity oozing from it forms.

CASE XV. No. 10. SYMBIOTES BOVIS (*Gerlach*), (Sarcoptes bovis, *Hering;* Chorioptes capræ, *Gervais;* Symbiotes equi, *Gerl.;* Sarcodermatodectes capreæ, *Delaf.* and *Bour.;* Dermatophagus bovis, *Furst.*).—**10.** Magnified sketch of male, under side.

The characters of this genus do not differ greatly from those of Sarcoptes. It has only one pair of chelate mandibles, and other differences will be seen in the accompanying woodcuts, which show the figure of the mite and of its suckers or ambulacra, which also furnish a good generic character; in the female the



Symbiotes bovis. Copied from Furstenberg's figure.



Symbiotes bovis, anterior leg and sucker. Copied from Furstenberg.

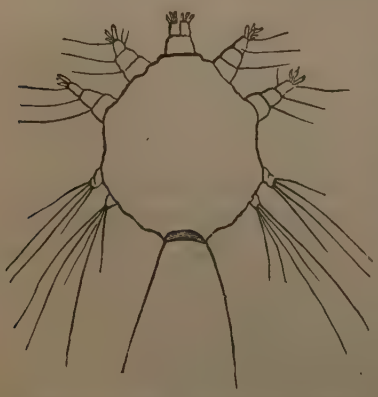
two posterior pairs of legs terminate each in two long bristles. The suckers are remarkable for their great development in this species. In many other species of mite (as in the Hydrachnidæ and Hypopi, for example) they are more numerous, but here they are larger. There is a large pair at the posterior part of the male, and like those of the feet they are bowl- and cup-shaped. It really seems as if Nature in making these creatures, had her head so full of sucking apparatus that she scattered them about in various places out of pure prodigality, and for all sorts of uses —for walking, for sitting still, for holding on, and for adhering to one another.

CASE XV. Delafond and Bourguignon figure this species as the itch mite of the goat, but there is no doubt that it is the same as that of the goat and ox, and that it is found on all three is due, as in the species that infests the tame rabbit, to the frequent and close communication between domestic animals. It generally attacks the goat about the sides of the neck, behind the ears, on the back and loins, the base of the tail, &c.; but also wherever the mite happens to have effected a lodgment. It is found also on the horse, attacking it at first about the pasterns. It sometimes makes great havoc among goats. Delafond and Bourguignon found that in the valley of Prattigau, in the Grisons, Switzerland, in the years 1851, 1852, and 1853, out of upwards of 2500 goats the half was attacked, and 500 died.

Genus SARCOPTERUS (*Nitzsch*).

Confined to birds. In the two anterior pairs of legs the suckers are replaced by claws, and in the posterior pairs by hairs.

No. 11. SARCOPTERUS NIDULANS (*Nitzsch*), (*Giebel.*, Zeitsch. Ges. Naturw. iv. 29).—**11.** Magnified sketch of ditto, copied from Giebel's figure.



Sarcopterus nidulans. Copied from Giebel's figure.

This species, which is closely allied to the genus Sarcoptes, was first described and figured by Nitzsch in Ersch and Graben's Encyclop. 1818, I. 249 — afterwards by Giebel in his paper above quoted.—It was found on the lark (Alauda arvensis) and green linnet (Fringilla chloris). It lives in the skin alone, and makes regular and irregular thick yellow knots, eight lines long by six lines broad. These yellow knots

CASE XV. have a single skin cover, and their contents consist partly of yellow débris made by the mites, and partly of a dry white mealy mass, composed of eggs and shreds of stripped-off skin. The body is striated as in the other Sarcoptidæ. The embryo and young are orange yellow.

Section II.—Louse Mites infesting the smaller Mammals.

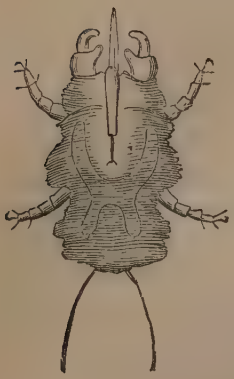
Genus Myobia (*Clap.*).

The next sections of the Sarcoptidæ consist of two tribes, neither of which burrow under the skin, but merely live on it. One of the sections is found on the smaller mammals, and the other confined to birds, both of which again may be further subdivided into genera. Both sections have been by some referred to the genus Dermaleichus, but it will be seen that there are very material differences between them. Of those that live on small mammals (on which we now enter), some have a styliform sucking rostrum, and these, no doubt, live by sucking the juices of the skin, while others are provided with minute mandibles, and these must therefore feed by browsing either upon the fur or the skin of their hosts. To the former sort belongs the genus Myobia; to the latter, Listrophorus and Myocoptes. Both sections exhibit remarkable modifications of various parts to suit their special conditions of life.

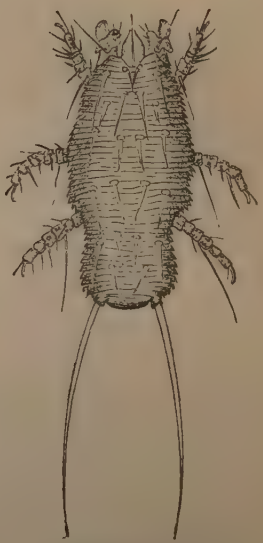
Nos. 12, 13. Myobia musculi (Pediculus muris musculi) *Schrank*, (Myobia coarctata, *Heyden*).—**12.** Magnified sketch of male; **13.** Ditto of female. Both taken from figures in Claparède's Studien an Acariden.

The woodcuts show the form of this species, both young and full grown, and of its mouth and anterior legs. The latter are converted into thick stumps, so near the mouth that they may be mistaken for palpi, with a curious flexible twisted clasping apparatus at their termination, by which the mite holds on to the hairs of its host. Consequently the species is so transmogrified that it appears only to have six legs; but the figure of the

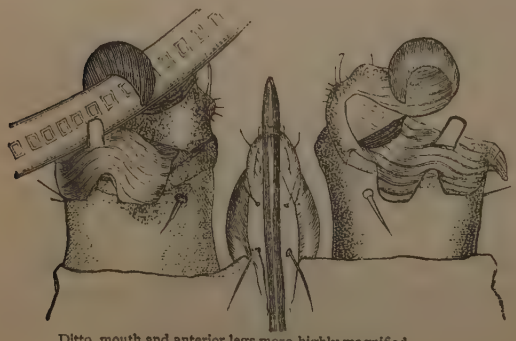
CASE XV. young shows as if *it* had only four legs, and the position of the claspers sufficiently proves that these in reality are the anterior



Myobia musculi (young).
Copied from Claparède's figure.



Myobia musculi (female)
Copied from Claparède.



Ditto, mouth and anterior legs more highly magnified.
Copied from Claparède.

Ditto, tarsus and claw, posterior leg.
Copied from Claparède.

legs. The tarsi of the other legs have no suckers, but a long thin feeble claw.

CASE XV. This species, according to Claparède, is almost entirely confined to the house mouse. He on one occasion, but only once, met with two examples on the field mouse. He notices a curious fact regarding the distribution of it, and Myocoptes musculinus on mice, which cannot fail to remind the reader of the assignment of two different species of lice respectively to the head and body of man. He says that this distribution in mice is regular to a degree. The Myobia musculi lives only upon the snout, the head, round about the ears, and, in an exceptional way, down towards the throat, but scarcely ever further down. The Myocoptes, on the contrary, confine themselves almost entirely to the abdominal region, although sometimes they wander to the back and sides. Usually there exists a somewhat broad neutral region or zone which separates them from one another; where no parasites are to be found. This species is more easily found than the other, because of its greater size; in this respect reversing the rule with the Pediculi on man, when the smallest species is found on the head, and the largest lives on the body.

Genus OTONYSSUS (*Kolenati*, Kentniss der Arach. in Sitz. Zool. Bot. Akad. Wiss. Wien, 1858, p. 69).

This genus was founded by Kolenati for a type of acarids that seem specially told off for living on the ears of bats. While placing it among the Pteroptidæ he seems to have regarded it as a link between the Dermanyssi and them, and it certainly has some of the characters of each. It has the sac-like body of the Dermanyssi, and at least one character of the Pteroptidæ, the possession of bristles formed after the fashion of those of that genus, that is, jointed like the hairs of the bats themselves; and if we had nothing to go by but the details given by Kolenati, we should have been greatly puzzled where to place them if not where he has. But we have the advantage of an exhaustive account, and very careful facsimile sketches in all its parts of a species which we cannot doubt to belong to this genus, published

CASE XV. by Dr. Maddox in the Monthly Micro. Journ., 1871, obtained from the ears of a pipistrel from Scotland, and from these we see that Kolenati has fallen into error on some important points. He was one of the curators of the museum at Vienna, and it is

Magnified hair of English bat. Copied from Queckett.

Magnified hair from the body of Otonyssus ticholasius. Copie from Kolenati.

not unreasonable to conjecture that he got most of his species of bat-mites from the dead or dried specimens of bats in the museum, which, of course, are less favourable for accurate observation than fresher specimens. Whatever be the cause, however, he has fallen into the mistake of saying that the legs of this genus are eight-jointed when they are only five-jointed; its palpi four-jointed when they are only three-jointed, and figures them as projecting instead of lying close to the mandibles; and the other parts of the mouth, as described by him, are not recognisable when compared with those figured by Dr. Maddox. The reader may say "They cannot be the same." So we thought at first; but after studying them again and again, and finding that they agreed in every point on which error was difficult, and only differed on those where error was easy, we have come to the conclusion that they are the same, and that Kolenati's description is not so accurate as that of Maddox. The place of their occurrence is

Bristle of palpi of Otonyssus sticholasius. Copied from Kolenati.

CASE XV. the same; their form and general appearance the same; they are transversely striated like the Sarcoptidæ; both bear a number of feathered bristles like those of Glyciphagus; they have a somewhat similar disposition of claws—no caruncles—but a long one with two short ones, while Myobia has a long one with hairs approaching to spines, and the same form of legs, for Kolenati figures a part of the leg, and that corresponds with Dr. Maddox's, and both have the mandibles chelate. Kolenati indeed speaks of a "pelotte," by which we understand a caruncle, but his enlarged figure shows none. Maddox does not figure, and no doubt did not observe the Pteroptine hairs figured by Kolenati from his species; but they may have been there notwithstanding.

With such remarkable coincidences in unusual points of structure it seems more likely that Kolenati has erred in regarding the number of joints in the legs as the same as that of the Pteroptidæ and Dermanyssi with which he placed them, than that there should be two types with the same unusual points of structure on the bat; the one with eight joints to the legs, and the other with five. It is

Tarsus of Otonyssus.
Copied from Kolenati.

Leg of Otonyssus.
Copied from Maddox.

not difficult to see how this error may have originated. The last joint in Dr. Maddox's figure of the leg is very long, and it has more than one projection, which might easily be taken for the margin of a joint, which would make the last joint short like Kolenati's. As regards the difference in the number of joints of the palpi, that may be merely a difference in the mode of calculation; Kolenati reckoning the basal elevation, from which they start, as a joint, which we do not; and their projecting away

CASE XV.

from the mandibles may be an error of the draughtsman, produced by attempting to show them more clearly.

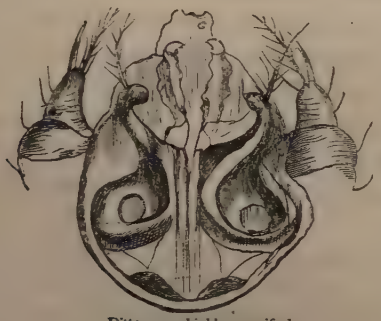
Palpus of Otonyssus sticholasius. Copied from Kolenati's figure.

Accepting then Dr. Maddox's species as belonging to the genus Otonyssus, and taking his characters as the true ones where they are positive, and ignoring characters not mentioned on either side, we find that the only family which possesses the same characters is the Sarcoptidæ. The five-jointed legs, the three-jointed adpressed palpi, the mouth with a camerostome, and the striated surface, all are characters of that family and that family only, and the form of the legs and claws are those of the section of it to which the mouse-parasite Myobia belongs. It holds out a hand to the Pteroptidæ in the form of its hairs, and to Glyciphagus in that of its bristles, and it may be the connecting link between them and the true Sarcoptidæ respectively, although it may be said that there is no more reason why Otonyssus should be allied to Pteroptus because they have got hairs on the same plan, than that both or either should be allied to the bats themselves, which have them too.

We have said that its mouth has the camerostome of the Sarcoptidæ; but this gives rise to a question that has puzzled us a good deal, namely, the true meaning of Dr. Maddox's figure of the mouth. We have given an exact copy of it so that the reader can judge for himself whether we interpret it aright. In the first place Dr. Maddox has not said whether the mouth is represented from above or below; but the context and a portion of the back figured along with it (which we have not thought it necessary to reproduce), shew that it is meant to represent it as seen from above. But if so it seems to us physically impossible that it can be correct. It makes the opening of the mouth to lie upwards, although the beast sticks on, and feeds *ventre à terre*, and it puts

CASE XV. the maxillæ before the mandibles, which is as bad as if we were to put our lips behind our teeth. According to our view, the

Mouth of Otonyssus sticholasius. Copied from Maddox.



Ditto, more highly magnified.

figure shews the mouth as looked at from beneath, or as if the animal were lying on its back and we were looking down its throat. That Dr. Maddox looked at it from above we do not doubt, but we imagine that in looking through them he has been deceived as to the perspective of the parts. It is to be remembered that we are looking at the mouth of a creature only a fifty-eighth of an inch in length and whose tissues are transparent. Moreover, Dr. Maddox tells us that his specimens were not examined in life, but after being in glycerine and spirits of wine and then treated with liquor of potass, and the laxity of the tissues, after being in it and the great displacement that occurs in neighbouring parts from slight compression, almost prevent the possibility of assigning to each the proper position, while in the natural state being often covered with exudation from the wound that the parasite itself has made and filled with dense grumous matter, exactitude in the description is by no means easy. Dr. Maddox has little reason to complain, for the drawing of the parts generally is admirable; but in this instance we think he has failed to recognise the relative depth at which the different parts of the mouth stood from his eye. We would correct his reading

CASE XV.

of his figure as follows: He calls the large curved claspers the superior maxillæ, (his nomenclature is more anatomical than entomological) by which he no doubt means the mandibles (a term he does not use) and the small hooks in the middle front of all the inferior maxillæ. We regard the latter as the mandibles and the former as metamorphosed maxillæ; and it is to be said in support of this view, that in the genus Listrophorus which also has a part of the mouth metamorphosed into a clasper that part is the maxillæ too. The central shred of membrane in front of these small hooks he calls the lingua (ligula), we should call it part of the camerostome; as to what we regard as the palpi on each side, he simply styles them two short conical cheliceræ supporting a long bifid claw. The species described by Dr. Maddox sticks on to the ear of the bat so firmly that they had to be detached by force, and they appear to fix themselves by the mouth or head sticking to one spot, and by their presence causing a considerable amount of mischief and inducing much congestion and thickening of the tissue beneath. Dr. Maddox figures the swollen spaces around their point of adhesion. All the specimens that he saw were six-footed, and he argued from so many as fifty being present that they surely could not all be immature. Kolenati's specimens were also six-footed, but he nevertheless regards them as mature, and speaks of a blank being left between the second and fourth pair of legs for the appearance of the absent pair which he assumes to be the third. In this he is misled by assuming that they belong to the Dermanyssi; the system observed in all the other known instances of the later appearance of an absent pair of legs, is opposed to their being the third. These are invariably the fourth pair and take their place behind all the rest, and the blank of which he speaks after the second pair is merely a character common to all the Sarcoptidæ, although not to the Dermanyssi. We do not exactly gather whether Kolenati ever saw any with four pairs of legs. He says something that would seem to infer at least that such have been met with: "hitherto all

CASE XV.

the species of ear mites have been to me six-footed, very rarely eight-footed have been met with." If they are the young of any other bat parasite, with eight legs, we are at least not able to indicate its probable parent.

OTONYSSUS STICHOLASIUS (*Kolen.*, Sitz. Akad. Wissench. Wien, 1858, p. 73. Acarus sp. Maddox in Monthly Microsc. Jour., 1871, p. 144).

This species has been obtained by Kolenati from the pipistrel, and it seems to be the same as the species seen and so well described by Dr. Maddox. One of Kolenati's specific characters

Otonyssus sticholasius. Copied from Kolenat..

Ditto, copied from Maddox.

of it is that his species has four transverse rows of four or five bristles each on its back. In this it agrees with the species of Dr. Maddox. They differ however slightly in colour, that of the latter being brown while Kolenati's is deep cherry red, which may probably be due to the difference in freshness or degree of digestion of the contained food.

On the pipistrel—Austria. Scotland.

Kolenati describes five other species of Otonyssus from the ears of different bats.

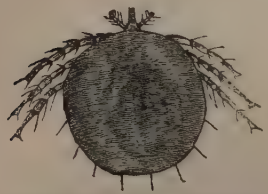
Genus PEPLONYSSUS (*Kolen.* Sitz. Akad. Wiss. Wien, 1858, p. 74).

This is a genus nearly allied to the preceding and which has been styled the top shaped mites by Kolenati. He says that the legs are eight-jointed, which we presume must be an error because of its obvious affinity to the preceding, and from his description of the legs and claws being the same as of its allies, but we have

CASE XV. never seen any of the species, and merely hazard its location here as a probable conjecture. He has described six species, and we copy his figures of two of them. The bristles or hairs are somewhat peculiar, varying in each species, but apparently of the same type in all. From the figures the texture of the skin would appear to be transversely striated as in the preceding genus, although this is not specially mentioned by Kolenati.

PEPLONYSSUS SEMINULUM (*Kolenati*, Sitz. Akad. Wissen. Wien, 1858, p. 75).

Yellowish brown. From the ears and skin of Nycteris thebaica, in Egypt.



Peplonyssus seminulum. Copied from Kolenati. 0·002 Parisian metres in length.

Peplonyssus pagurus. Copied from Kolenati. 0·0008 Parisian inches in length.

PEPLONYSSUS PAGURUS (*Kolen.*, loc. cit. p. 78).

Yellowish brown. On Rhinopoma microphyllum, Geoffr., in Egypt.

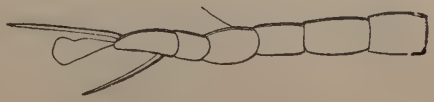
Genus LISTROPHORUS (*Pagenstecher*).

The Listrophori are another type of parasitic mites found upon small mammals. Claparède speaks as if they were confined to the rodents such as field mice, but it would appear not to be wholly so. We have specimens of Listrophorus gibbus from the ferret, and another species from the polecat; and seeing that these beasts of prey must often feed on field mice, it is not very difficult to imagine that they may more or less frequently be invaded by their parasites.

This genus furnishes a scarcely less remarkable instance of modification of structure to purpose than Myobia. In Listrophorus the maxillæ are transformed into two flexible shovels or

claspers, as shown in the woodcut, with which the creature clasps the hair of the mammal on which it lives.

Mouth of Listrophorus Leuckarti. Copied from Claparède.



Leg of ditto. Ditto.

From the general resemblance of the snout to that of Myocoptes, which we figure below, it is probably formed on the same plan, although we do not know that it has been actually deciphered. Full details of their structure are given by Pagenstecher, (loc. cit.) and especially by Claparède in his Studien an Acareden.

14. LISTROPHORUS GIBBUS (*Pagenst.*, Zeitschr. fur Wiss. Zool. XI., 156).—14 Magnified sketch of ditto, copied from Pagenstecher's figure.

Listrophorus gibbus. Very minute. Copied from Pagenstecher's figure.

Listrophorus leuckarti. Very minute. Copied from Claparède.

Found on field-mice and in England on the ferret.

15. LISTROPHORUS LEUCKARTI (*Pagenst.*, Zeitschr. f. Wiss. Zool. XI. 109).—15. Magnified sketch of ditto, copied from Claparède's figure.

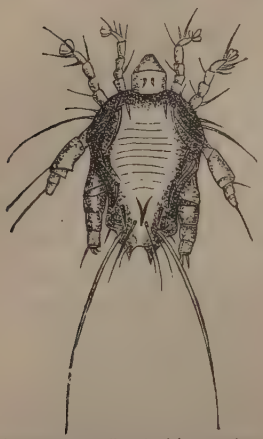
Found on mice.

Genus MYOCOPTES (*Clap.*, Zeitschr. f. Wiss. Zool. XVIII.).

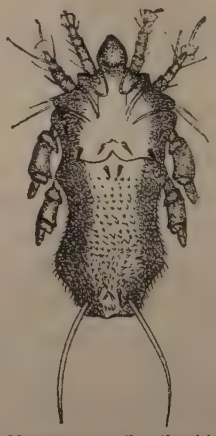
This genus supplies the bridge which leads us to the Bird-louse-

CASE XV. mites, and has much of their appearance, although also much of that of the foregoing mouse-mites.

Nos. 16, 17. MYOCOPTES MUSCULINUS (Pediculus muris musculi, *Schrank.*; Dermaleichus musculinus, *Koch*).—**16.** Magnified sketch of male and female insects. **17.** Ditto of female. Both copied from Claparède's figures.



Myocoptes musculinus (male), very minute. Copied from Claparède.



Myocoptes musculinus (female). Ditto.

Ditto, seen from in front. Copied from Claparède.

Ditto, mouth.

Koch, in describing this species, says that it is not abundant. M. Claparède at Geneva found it very much the reverse. Every mouse without exception swarmed with them in great numbers, and under two forms, for the male differs from the female very much. Koch appears only to have known the female. This mite Claparède found also here and there upon Hypudaeus arvalis, and still more numerously upon the shrew-mouse. We have already noticed under Myobia the peculiar limitation of this species to the body of the mouse, while Myobia is assigned to the head.

CASE XV.

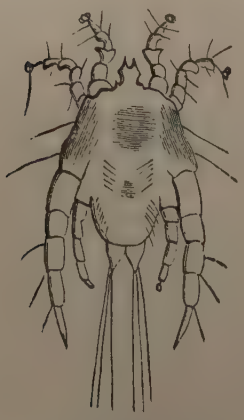
Section III.—Louse-Mites infesting Birds.

Genus Dermaleichus (*Koch*). (Analges, *Nitzsch*).

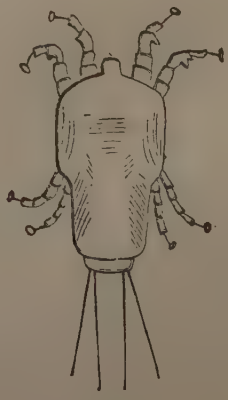
There is no doubt as to the place of this section, although the striation or wrinkling of the skin is so fine that it requires a good microscope to see it. We are, however, somewhat in doubt whether its right name should be Dermaleichus or Analges. General consent has approved the name Dermaleichus, which was proposed for it by Koch, as a genus of Sarcoptidæ in 1839; but we see from a note by Claparède, in his "Studien an Acariden," that while he adopts the name Dermaleichus, he considers that the priority belongs to Analges, a name given to the genus by Nitzsch. We cannot lay our hands on Nitzsch's notice, but the name is again brought forward by Giebel in 1871, in a paper in the "Zeitsch. Gesam. Naturw., iv.," where he describes and notices seventeen species parasitic on various birds. His application of the name Analges is confined to Bird-mites that feed on feathers; but, as we believe they all do so, it follows that Analges and Dermaleichus, as restricted to birds, are synonymous terms for the same thing. In the previous year (1870), Buckholz had described and figured a still larger number under the name Dermaleichus ("Verh. L. C. Ges., xxxv., 1870"). The number of species is very great, almost every bird having a distinct species allotted to it, and some two or three; almost every collection has a number of undescribed species; and no general monograph of them has yet been attempted. We were in hopes that this would have been done by Professor Robin, the most competent authority; for in 1868, he gave an account of his observations on mites infesting birds, a preliminary resumé of which appeared in the "Comptes Rendus," lxvi., but we have waited with impatience for its further publication, which has not yet taken place. He proposes four new genera — Pterolichus, Pteronyssus (type Dermaleichus

CASE XV. picinus), Proctophyllodes (type D. glandarinus), and Pterodectes, but the characters are still to follow. He found that the males pass through four, and the females through five stages—the egg, the hexapod larva, the octopod larva or nymph without sexual organs, sexual males or females without external sexual organs, and sexual and fecundated females. These two last stages explain the meaning of a fact, that had been previously observed, that in Dermaleichus there were two forms of females. There is very considerable difference in form between the sexes, the male being the largest, and often being provided with monstrous and exaggerated limbs, especially the third pair. There is also much difference between some of the species, although others are very close to each other. Some idea of these differences may be gathered from the species that we have represented in the case, and from the accompanying woodcuts.

DERMALEICHUS BIFIDUS (*Buckholz*, loc. cit.)



Dermaleichus bifidus (male). Copied from Buckholz.

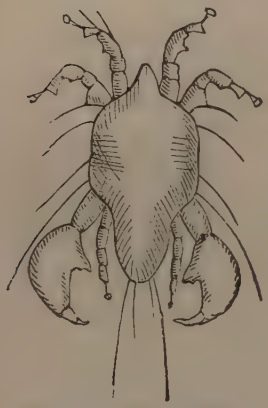


Ditto (female).

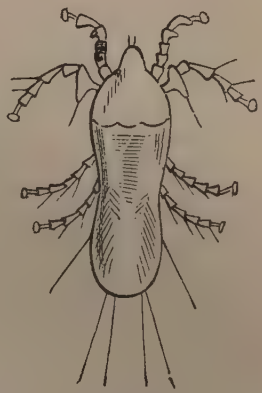
Nos. 18, 19. DERMALEICHUS, *Sp.* From the rook.—**18.** Magnified sketch of male; **19** Ditto of female.

CASE XV. Nos. 20, 21. DERMALEICHUS PICI MAJORIS (*Buckholz*). From the greater woodpecker.—**20.** Magnified sketch of male; **21.** Ditto of female. Copied from Buckholz's figures.

No. 22. DERMALEICHUS CHELOPUS (*Herm.*; D. passerinus, *Koch*). From the sparrow.—**22.** Magnified sketch of male.



Dermaleichus chelopus (male).



Ditto (female).

This is very like, although in some respects it slightly differs from, the Acarus passerinus of Koch; but these discrepancies are probably only differences in maturity, or drawing.

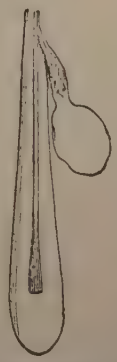
Genus INCERTÆ SEDIS.

Nos. 23, 24. DEMODEX FOLLICULORUM (*Simon*, *Owen*, &c.)—**23.** Magnified sketch of bulb of a human hair, with the sebaceous follicle attached, in the tube of which a minute speck represents the insect; **24.** Magnified sketch of the insect.

This minute animal which is from 1-50th to 1-100th of an inch in length, is a parasite that lives in the sebaceous sacs and hair follicles of the human skin. Considerable difference of opinion has existed amongst naturalists as to its proper place in the animal kingdom—but there seems little doubt that it is an Acarid, although the mode of articulation of its thorax is anomalous.

CASE XV. Professor Owen considers that it represents the lowest organised form of the class Arachnidæ and that it makes a transition from the Anellids to the higher articulates. If an Acarid it comes nearer the Sarcoptidæ than any other, and we have thought the present as proper a place as we could find for it. Still we own that it comes in awkwardly, and as Dean Swift once said, if the judicious reader can assign it a fitter place, we do here empower him to remove it into any other corner he pleases. The more important points of affinity are the structure of the mouth which is suctorial, the transversely striated skin, and its larval development. The latter is hexapod.

Demodex folliculorum. Copied from Owen's figure.



Ditto in bulb and sebaceous follicle of human hair.

Its habits are in some respects similar to those of some of the Sarcoptidæ. It is not a normal inhabitant of the hair follicles or sebaceous glands, but appears to make its way into them from without.

Either the same or an allied species has been found in the contents of the pustules of a mangy dog, when they occurred in such abundance that thirty or forty were frequently seen in a single drop of pus. It has not been discovered whether the insect had anything to do with originating the mange, or had merely taken advantage of its previous existence to establish itself in the pustules, nor does it appear whether the instance referred to was an isolated case or not (see Owen's Lectures on Invert. Comp. Anatomy, 2nd ed., p. 444).

In 1872 Pennetier described a species which he named D. caninus (Bull. Soc. Rouen), which is probably the same as the above.

CASE XVI.

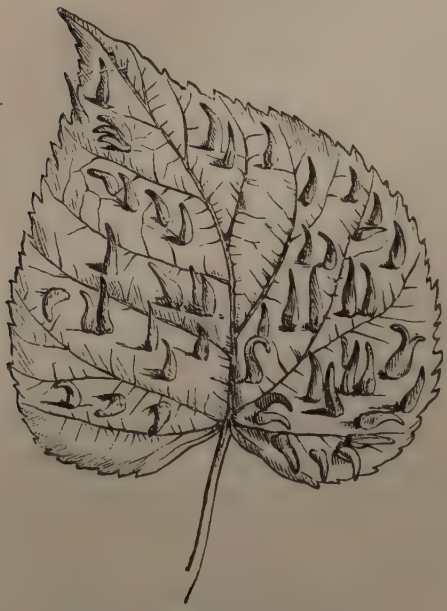
Sub-Family PHYTOPTIDÆ. (Gall Mites.)

This is a most abnormal and exceptional group, which has puzzled and continues to puzzle entomologists more than have any of the other mites, difficult as it is to determine the true affinities and place of some of them. We think that this is its proper place, but we speak with bated breath and becoming diffidence. We shall presently explain the different positions that have been or may be assigned to them, with the reasons for or against their adoption. But we must first let the reader know what the Phytopti are, and something about their peculiarities and mode of life.

Most of our readers must have noticed curious galls, excrescences or growths, upon the leaves or other parts of various plants. These are produced by various kinds of insects; and the discovery of the species of insect by which they are produced has occupied the attention of entomologists ever since entomology became a science. Many of them are not difficult of determination, in this respect, that, if they are cut open, a single grub is usually found to be inhabiting the gall which could be referred to the particular family with whose larvæ the tenant corresponded, these being all pretty well known; or, to make perfectly sure, the perfect insect could be bred from the gall. The larvæ in such galls are usually solitary; or, when the gall contains more than one individual, each individual occupies a separate cell in the gall. There are some growths, however, which look like galls, and some which look like dust or powder, the origin of which has puzzled naturalists, because, whether shaped like a gall or not, no grub was to be found; and, in its absence, they jumped to the conclusion that they were cryptogamic growths or minute fungi. This idea once received, botanists took them under their charge and described the various kinds under the name of Erineum, etc. Subsequent discoveries, however, have shown

CASE XVI

that these species of Erineum, in almost every case, are growths or products caused by some species of the small mite which we have now under consideration; a mite so small and sometimes so crystalline and transparent (as in the Phytoptus of the ash for example) that it cannot be seen in the gall at all, and it is only by washing out the galls and searching for them in the water in which they have been washed that it can be known that



Leaf of lime-tree bearing nail-galls (work of a mite).

Section of nail-gall of lime leaf.

there has been a living creature there at all. The first step towards a knowledge of them was made nearly a hundred and fifty years ago, by Reaumur, the celebrated French entomologist. There sometimes occurs on the leaf of the lime-tree a number of upright projecting small growths, varying from green through red to brown in colour, and which look very much as if a

CASE XVI. number of small tacks had been driven through the leaf from the under side, whence it was named either by him or others the lime-leaf nail-gall. Now this nail-gall, when cut open and examined, usually appears empty of any living inhabitants, not empty in itself, but filled with a mass of fine vegetable hairs of the nature of those that cover the under side of the leaf, but longer, and exaggerated in size and number. Reaumur, like many others, for long examined hundreds of these galls without finding any insect in them; but he records that at last he found that his failure was due to his searching for them too late; and that, when he subsequently examined them at an earlier stage while they were still green, he found insects in almost every gall examined. He adds, that he never saw more than one in each; although there was an appearance as if they might be in company; and he describes them as long; under a strong glass not appearing thicker than the stalk of a small pin. They were yellowish, like the interior of the gall. What makes them more difficult to find, says he, is that they do not like to walk. "I often saw one, but was uncertain whether it was a grub or not, until it pleased to put itself in motion. It is towards the base of the gall that we find them: when the galls get old, some opening or crack takes place, by which mites and strange insects introduce themselves. I have seen, for example, mites ensconced there." It is now ascertained that mites are not only ensconced there, but are the makers of the gall; and Reaumur's observations had been quoted to show that it was them that he discovered. We cannot agree with this: the closing words of his remarks which we have quoted seem to show that he was perfectly alive to the distinction between a mite and a small grub; and although Reaumur might be, and probably was correct in assigning the early time of these galls as the date when their makers were to be found inside, yet, we believe the grubs that he saw were not themselves Phytopti, but possibly some carnivorous larvæ that had come in to feed upon them. We suspect he never saw the Phytopti themselves, for he only found one grub in each

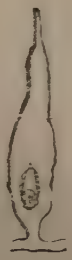
CASE XVI.

gall; whereas, wherever Phytopti do occur, it is not in single file, but in battalions. Besides, they are so very small that we doubt very much, if only one were put inside a nail-gall, whether we could find it again in such a comparatively spacious hall. Moreover he speaks of the cottony hairs filling up the interior. It is true that, where he does so, he is speaking of his ineffectual search for them, and its absence may have escaped his notice when he found the grub; but if phytopti were feeding in the gall, the hairs would have been mowed down. We never saw hairs, or, at all events, long crowded hairs, or indeed anything but their remains, in mite-galls in which Phytopti were present; and we saw Phytopti in mite galls in which hairs were abundant.

We may also in passing correct the misconception which Reaumur has expressed as to a crack taking place in the gall. Strictly speaking, the mite-galls are not galls in the sense of being enclosed portions of vegetable tissue in the midst of which the larva lives. They are merely abnormal thickened growths of a portion of the leaf; and the thickening being unequal, usually greatest on the upper side of the leaf, it there expands like a round gall while the under side is drawn up in the interior like the open mouth of a purse. By this character, mite-galls can always be known: they always have an opening leading into them, and generally from the under side or margin of the leaf. The importance of this distinction will be more evident when it is remembered that there is nothing to hinder galls made by other insects from assuming a form similar to the growths caused by mite-galls; and, in point of fact, some of them are remarkably alike: for example, we have above given a figure of the lime-leaf covered by nail-galls made by a mite; and here is that of a North American vine-leaf covered by similar nail-galls (called by American entomologists the trumpet grape gall) made by a Cecidomyia (a small gnat-like fly). They look identical, and any one would naturally expect that they were both made by a like architect; but sections of them respectively show that the former has an

CASE XVI. opening to the interior from the under side of the leaf, while the latter has none, but is a closed sack.

Leaf of American vine bearing trumpet galls (work of a Cecidomyia). Copied from Mr. Riley's figure.



Section of ditto, drawn from description.

But to return to the history of the discovery of the makers of these galls: Whether Reaumur saw them or not, at least no one else did for about 100 years after. About 1832 and 1834, however, the publication of M. Dugés' valuable papers on the classification of the Acaridæ to which we have already had so often to refer, gave an impulse to their study, which led to fresh discoveries; and M. Turpin observed in the nail-galls of the lime-leaf, a quantity of very minute semi-transparent fleshy mites of a new and hitherto unknown form—a narrow creature with two pairs of small legs at its head, and some kind of sucker apparatus at its tail, on which it rests and raises itself, swaying about its body. He regarded it as a species of Sarcoptes.

The different views enunciated on each successive discovery by

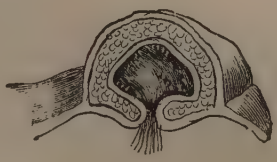
CASE XVI. the best authorities are very instructive, and the reader will therefore excuse our going a little into detail regarding it.

M. Dugés, then, the first authority of the time upon mites, remarked in two papers upon M. Turpin's discovery. In his first observations, he mentions that M. Turpin's drawings were unfortunately not published, and he only knew his descriptions from insufficient extracts; but, from some verbal explanations which he had received from him, he had learned that it was not by a complete analysis of the mouth that this distinguished naturalist had formed his diagnosis, which besides, even although made, must still have been very uncertain. M. Dugés had then himself set to work to find M. Turpin's mite, but failed, altho' he met with some Tetranychus teliarius laying their eggs at the very door or entrance of the galls; and he then suggests that it may have been its offspring that M. Turpin had seen, acknowledging at the same time that M. Geoffrey St. Hilaire, who had seen M. Turpin's drawings, could find no identity between it and the specimens of Tetranychus teliarius shown him by M Dugés.

Not long afterwards, however, M. Dugés was more successful in his search. Abundant rains had fallen, and he profited by the first fine days in searching on the black poplar for the galls said to occur on it, and he found some on the white willow, but not on the poplar. These were smaller, rounder than those of the lime; green or reddish, and covered with down outside: they project on the upper and under side of the leaf, but more on the upper side. Like those of the lime, they open underneath by a hole, which is obstructed by the villose filaments which are found inside. In the interior, however, these filaments were less abundant; and there he easily found, in great numbers, the mites of M. Turpin. He again searched and found them also in the galls of the lime. As to the more advanced galls, he found the walls often quite covered with these supposed Sarcoptes: they were very small, whitish, vermiform; and, as he supposed, very probably one of those which Reaumur speaks of having noticed, and which

CASE XVI. he said, with reason, were scarcely to be distinguished from the vegetable filaments but for their movements. No doubt, says he, it was the outer form or habitus of this animalcule that induced

Sallow leaves with galls produced by Phytoptus salicis.



Section of sallow mite gall.

Latreille to refer it to Sarcoptes when M. Turpin furnished him with his drawings; but a more minute research, although very difficult by reason of the excessive smallness of the animal, showed:—first, that the conical sucker was flanked by two thick short appendiculated palpi, similar to those of Tetranychus; secondly, from this sucker there sometimes (once) came out by compression a curved plate or blade, narrow and long; thirdly, the feet were in seven parts, of which the third, or the thigh, was the thickest and longest, and the seventh on the contrary much reduced, very short and probably terminated by two claws, but certainly not by a caruncle. Thus, if the form of the palpi, the mandibles and feet, were considered, he said this mite ought to be classed

CASE XVI. in the family of the Trombidiidæ, near Tetranychus; or again the number of feet would prove that it was only a larva and not a perfect mite, because there were only two pairs, and the other larvæ have usually one more. But if that were so whence came the eggs that were also found in the galls? He felt no doubt that they were deposited by adult individuals, who had come there to lay their eggs. The free entrance to these galls would allow them to come in, just as it would allow insects newly arrived at maturity to go out. The latter point he proved by the following facts:—first, that many of these little beings were seen to become motionless, changed into elongated pupæ, in which the body was already seen to contract, abandoning the extremities of its cutaneous case; secondly, two or three times small mites with eight feet had been seen in the galls, white, short and agile, having all the characteristics (palpi and feet) of Tetranychus. Now and then, these little things resembled perfectly the larger reddish Tetranychus, which had been found several times in the large galls. These Tetranychus were not at all of the same species as those on the lime, which live on the back of the same leaves with their eggs and young. They were of a much smaller shape, and differed in some details of form and in the greenish colour of the one, and light red of the other.

In conclusion he acknowledges that a good deal of doubt rests upon the supposed affinities either with Sarcoptes or Tetranychus; and even upon the share they have in the production of the galls they live in.

Along with these remarks M. Dugés gave a figure of the mite he found, which quite corresponds with those of subsequent authors.

The next step was made by M. Dujardin, in 1851, when he also detected the same mites in the nail-gall of the lime-leaf, and published an account of them with a figure more highly magnified than that of M. Dugés. Under higher power, the body of the mite is seen to be transversely striated; but it is time that the

CASE XVI.

reader should see a representation of this curious creature. The accompanying woodcuts shew it respectively as it appears under a moderately strong lens, and under a higher power, and the smaller figure that looks as if it were casting its skin, is a copy of a figure of an individual supposed to be young, given by Professor Westwood. Up to this time it had always been taken for granted, that these mites must be the larvæ of some other mite. They had only four legs, instead of the full complement of eight,

Phytoptus salicis, as it appears when moderately magnified.

Phytoptus tiliæ, after Dujardin.

Young of Phytoptus ribis. Copied from Westwood's figure; possibly only the insect in process of casting its skin.

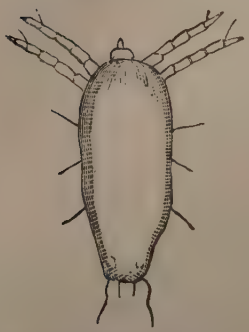
and consequently it was assumed must be larvæ. But it was overlooked that no larval form of mite had ever previously been found in which the legs were fewer than six: consequently, if these were larvæ, they were larvæ of some new type, and the difficulty of placing them was all the greater. M. Dujardin was alive to this; and, on careful examination, he thought he saw, through the semi-transparent skin, appearances of eggs within the body of some of them. He consequently regarded them as a new type of mite which he called Phytoptus.

If he is right in thinking the bodies he saw to be eggs, the mites must either be fourfooted in their mature stage, or the young must have the power of reproduction before attaining it, a power which no doubt does exist in some types of insects. The woodcut is a copy of Dujardin's figure with the supposed eggs

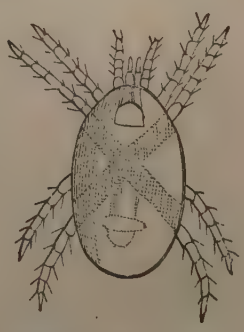
CASE XVI.

in them. We have never seen them in the mite of the lime-leaf nail-gall, because we have never been lucky enough to detect mites there at all; but, in other Phytopti, they are easily enough seen, and the impression left on our mind is in favour of their being eggs. It is not so with all observers, however, and notably it is opposed to the views of the author, M. A. Scheuten, who makes the next important contribution to the history of the Phytopti, and which if correct should settle the question of their true nature and affinity.

M. Scheuten's account of his observations was published in



Phytoptus pyri.
(Typhlodromus pyri of Scheuten.)
Copied from his figure.



Gamasus sp. Copied from Scheuten, who supposed it to be the perfect insect of Typhlodromus pyri.

Wiegman's "Archiv" for 1857, and translated into our own Annals and Magazine of Natural History in the same year. The leaves of the pear trees in his garden were attacked by black pustular inflated spots, under the epidermis of which he found the species of Phytoptus, which he named Typhlodromus pyri. On examining a large number of spotted leaves in his garden, in which all the pear trees were similarly attacked (one tree having a third of its leaves affected), he always found the same four-footed larvæ in the interior of the leaves, and, in most cases, on the exterior a species of eight-legged mite, which he took to be the perfect form of the Phytoptus. He gives figures of these, and from them it is plain that the so-called larva is a Phytoptus,

CASE XVI.

and the supposed perfect form a Gamasus. These are here shown. But, beyond the fact that he found these mites at times in the vicinity of each other, one within the gall and the other without it, he gives no explanation how he arrived at his conclusion. To be sure, we cannot expect very close evidence of the progress of development in such minute animals; but something better than mere contiguity or proximity should be given. There is not even similarity or analogy in any of the parts. He thinks, indeed, that he saw the half-developed larva, and gives a figure of it, which we here copy; but the reader will see that this is only a badly seen and badly drawn figure of a Hypopus.

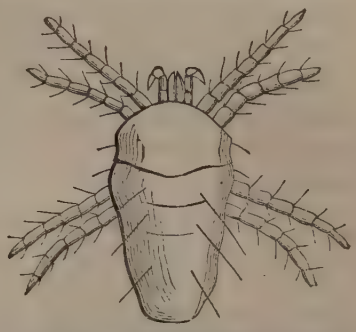
Figure of a Hypopus, badly drawn. Supposed by Scheuten to be the undeveloped larva of Typhlodromus. Copied from Scheuten's fig.

It is to be remarked, however, that in another species, called by him Flexipalpus tiliæ, which he observed on the lime trees, not in the nail-gall, but in a rust, or Erineum, on the under side of the leaves, named Erineum rubigo, there is a certain outward similarity of appearance between the larva and what Scheuten calls the perfect insect, as may be seen in the woodcuts; but here we agree with Claparède in thinking that this is merely a badly figured and badly described Tetranychus of the lime tree. We shall return to the consideration of, whether these mites are really the perfect form of the Phytopti, presently; but we must not omit his objection to Dujardin's notion that the rounded bodies, visible under the skin of the Phytopti, were eggs. He objects that Dujardin's only evidence that ova were in them was that he saw roundish structures shining through the skin of the animal. "Even with transmitted light," says he, "a very indistinct view of the interior can be obtained; and this is shown by his own figure. In this we see what he regards as eggs, but no trace of other viscera, for which, however, there is plenty of space." In the interior of *his* larvæ, on the other hand, various rounded

CASE XVI.

outlines were seen by M. Scheuten, especially when glycerine was employed. In the upper part of the body particularly there

Phytoptus, from Erineum rubigo on lime tree leaves (Flexipalpus tiliæ of Scheuten). Copied from his figure.



Badly drawn. Tetranychus tiliæ, erroneously supposed by Scheuten to be the perfect form of ditto (Flexipalpus tiliæ of Scheuten). Copied from his figure.

is constantly a round clear space, which also occurs in the same spot in the mite: then follow irregular roundings which, says he, are certainly nutritive organs. But merely to assert this is no proof, and the objections to Dujardin's statement are obviously weak. He objects that it could not be transparent, because Dujardin has described it as white and striated; and yet he himself immediately, not only confirms the transparency, but describes the very bodies that Dujardin saw. All who have seen these creatures know that they are semi-transparent, and that you may see the interior, as it were, through a milky glass.

It is not irrelevant to the question to add that M. Scheuten describes and figures another Gamasus under the name of Sannio rubrioculus, both in what he calls its young and mature stages, and that both the young and the old are furnished with eight legs. From this and some other minor indications, it rather seems to us that M. Scheuten had only taken up the study of the Acaridæ incidentally, and that his statements can hardly be accepted as right interpretations of what he saw, without confirmation.

Next, in 1864, Von Landois described from a new species

CASE XVI. (Phytoptus vitis), four stumps on the under side of the body, which he supposed were the aborted remains of the two missing feet. The extent and meaning of his statement rather than the accuracy of this observation has been questioned.

Since that time the Phytopti have become tolerably well known: that is, many observers have made themselves acquainted with them; and a few have, from time to time, described various species and the galls in which they have been found. The more important contributions of this nature have been furnished by Frauenfeld, who, in the years 1864, 1865, 1869, 1870, and 1872, has published papers on the subject in the "Verhandlungen Zoologische und Botanische Gesellschaft in Wien;" by Dr. Thomas in the "Zeitschr. Gesam. Naturw. (xxxiii)," and on Swiss Phytopti in the "Verh. St. Gall. Ges., 1870—1871," and by Dr. Franz Löw in "Verhand. Zool. and Bot. Ges. Wien" in 1874. In our country they seem to have been very little noticed. Apparently the first original observation was by the Rev. M. J. Berkeley, the eminent vegetable physiologist, to whom specimens of currant-buds, injured by a species of Phytoptus, had been sent, in 1869. These he brought before the scientific committee of the Horticultural Society; and, from these and other specimens Professor Westwood shortly afterwards described the species in the "Gardener's Chronicle." His description agrees with that of other authors, and need not detain us, but he has added, apparently on the authority of his correspondents, that at a later period of its life it acquires six legs. This is an important point, and deserving of further examination, for it has not been observed by any other author. He says, "From this statement it is evident that this creature retains its juvenile two-legged form for a considerable period, but at a later period (as we learn from T. C. of Glasgow, a good microscopic observer) they acquire six legs, as was seen in specimens from old buds sent to us near the end of October, when some had two well-developed bristles at the tail. These two bristles we believe to be the rudimental fourth pair of

CASE XVI. legs; whilst another writer (D. B., in the 'West of Scotland Horticultural Magazine' for November, 1865) states that on examining some of the dried-up buds of the same season's growth still remaining on the black currant bushes, he found the insects in a further state of progress. A good many of them had three pairs of legs, some of them with a pair of stout bristles, others with several stout hairs, and some of them with two projecting appendages at the termination of the abdomen. A few were also seen with four pairs of legs, being probably another species. Both of those having the six legs and the eight legs walked very nimbly, and speedily made their way out of the field of the microscope, and being so minute they could not easily be detected by the unassisted eye. The young larvæ were already to be found in the buds forming for the next year's crop."

It does not quite appear from this narrative whether Professor Westwood himself saw the six-footed species spoken of above as observed by his correspondent, T. C. This is an important point, for on it must depend how much weight is to be given to the observations which he reports. In a class of animals so minute and so little studied, and where to an uninstructed eye most different creatures may seem alike, we cannot be expected to accord the same faith to observations by anonymous correspondents that we should give to those of Professor Westwood himself, especially when these conclusions are unsupported by, not to say opposed to, the observations of other eminent naturalists. Professor Westwood, indeed, speaks of them as important, but from some remarks which he goes on to make on the egg question, it is obvious that he did not regard them as in any respect conclusive.

The Rev. Mr. Berkeley, whose strict accuracy and highly educated eye gives unusual weight to any statement he makes, was obviously inclined to believe in the round bodies being genuine eggs. He says ("Gardener's Chronicle," 1869) that, if he mistook not, he saw very frequently, within the body of the

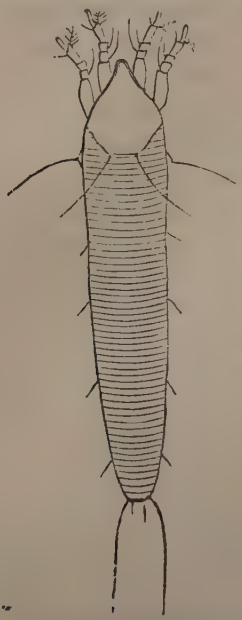
CASE XVI.

mite, an egg just ready to be protruded accompanied by one or two others in a state of progression, on which Professor Westwood suggests that this may be one of those cases in which the ordinary proceedings of insect life are departed from. "Parthenogenesis," says he, "or the production of offspring by a virgin or unmatured female, has been already observed among the Acaridæ, and we now know that the young larvæ of certain Cecidomyæ, or gall midges, are capable of producing fertile eggs, whilst others of the same larvæ are transformed in the usual manner into midges. Is it possible that this is a similar case of larval precocity? If, on the other hand, the creature produces eggs as a normal condition of its existence, we have here the case of a perfect Acaridan never assuming more than two pairs of legs, and which would require for its reception, not only a distinct generic name, but a distinct family of mites."

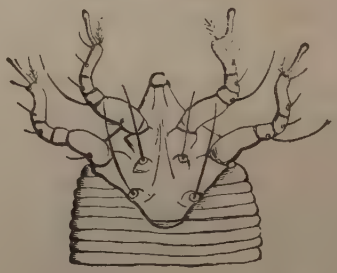
The latest contributor to our knowledge of the Phytopti is Dr. Franz Löw, who, in 1874, in the "Verhand. Zool. Bot. Gesells., in Wien," has published two important papers, giving an account of many mite-galls and their producers. He gives a figure of Phytoptus (part of which we here reproduce), in which, in place of the four stumps of feet that V. Landois thought he saw, there are seen four bristles springing from four warts, and he argues that it was by some displacement or ocular illusion proceeding from them, that V. Landois was deceived (if he was deceived). For ourselves we rather think that he was not, and that the difference between the observations of Landois and F. Löw is one of words rather than reality. V. Landois's four stumps of legs are doubtless F. Löw's four warts, which he regards as the homologues of legs.

These are the main circumstances connected with the past history of the Phytopti so far as we know them, but it is right to say that there may be others which have escaped us. Kaltenbach, in his Pflanzenfeinde, makes frequent reference to Dr. Amerling, of Prague, and Dr. Kirchner, of Taplitz, two Hungarian naturalists, as

CASE XVI. authorities for various names of mite-galls, whose papers, however, we have not succeeded in procuring.



Phytoptus. Copied from figure by Low.



Head of Phytoptus. Enlarged from figure by Dr. Low.

The reader may probably now ask what inference he is to draw as to the affinities and nature of Phytopti from the facts above mentioned. We have seen four conclusions drawn from their observation by respective authors. Dugés has suggested that they are the young forms of a species of Tetranychus. Scheuten, that they are the young of species of Gamasi. Latreille thought they belonged to the Sarcoptidæ; and Dujardin, that they were a special tribe by themselves. Let us take each of these alternatives by itself, and see what is to be said for and against it. Dugés supported his notion that they might be the young of Tetranychi, first, on the ground that the conical sucking apparatus is flanked by two large short appendiculated (finger and thumb), palpi

CASE XVI.

similar to those of the Tetranychi. Now the mandible-like objects may be short, stout palpi, but in no other description or figure of Phytoptus that we have seen, is there any sign ever given of them being appendiculated; indeed they are not represented at all in any highly magnified figure of the head that we have seen. Nor can we find anyone who has seen this. His next argument, that, by compression, a curved, long, narrow blade was made to project from the mouth, requires more elucidation. His last, that the legs are composed of seven articles, which are proportioned like those of Tetranychus, is erroneous; the legs of the Phytopti being only composed of five articles. But independent of this altogether, there is one fact that seems fatal to the idea of these being Tetranychi, or allied to them. The development of the Tetranychi and Trombidiidæ, as well as of their allies Hydrachnidæ and Bdellidæ, has been thoroughly wrought out. Many species have been traced through all their stages, and not one has been found whose early stage has not been six-footed, and very like the mature insect. The Tetranychi and their allies may, therefore, we imagine, be eliminated from the number of possible parents of the Phytopti.

Leg of Phytoptus.
Copied from Dr. Löw.

Next comes M. Scheuten and his Gamasidæ. The same objection applies to his view as to that of Dugés. The development of most of the types of Gamasidæ is perfectly well known, and has been ascertained to be six-footed in the young, and there is no reason to suppose that those types which have not yet been traced differ from the others in this respect.

As to the Sarcoptidæ again, the outward resemblance to them is much greater than to any other family of mites. Like them the Phytopti have short thick palpi flanking the mandibles. The number of joints in the legs of both is the same. As the structure of the legs is a point of some importance, we may quote Dr. Löw's description of those of the Phytopti. "The legs are distinctly

CASE XVI. five-jointed" (as shown in the above woodcut, copied from Dr. Löw's figure), "which five joints comprehend the coxa, femur, a

Tail of Phytoptus.

very short tibia, and two-jointed tarsus. The terminal joint of the tarsus, which is longer than its first, and somewhat knobbed at the end, bears a long round claw, which is only a little thickened and obtusely rounded at the tip. Beside this claw, inclined towards the inner side, is a feathered organ for holding on by, which has on each side five gradually diminishing branches."

Claw of Phytoptus (Typhlodromus) pyri. Copied from Scheuten.

Claw of Phytoptus (Flexipalpus) tiliæ. Copied from Scheuten.

This "haftorgan," or boat hook, as it were, differs in different species. The two figures taken from Scheuten, which we here give, show respectively its different forms in the different Phytopti specified under each, viz., with one hook in Typhlodromus pyri, two in Flexipalpus tiliæ, and there are five in that of the gall of Bromus mollis. We are strongly inclined to suspect that the right interpretation has not been put upon these organs. What does the animal want with another soft claw alongside the harder boat-hook? As we read it, the boat-hook is the claw, and the longer so-called claw is a sucker, like those of the Sarcoptidæ. We can point to an exact parallel to this arrangement of sucker and claw, and nearly in the same proportionate dimensions, in the termination of the leg in Symbiotes bovis, and Psoroptes equi among the Sarcoptidæ (see the woodcuts of these species). Again, the reader knows that it is an almost universal peculiarity of the Sarcoptidæ (so much so, that we have used it as a family character) to have the body finely

CASE XVI.

furrowed and striated, more or less, in a transverse direction. The Phytopti have the same peculiarity too. Notwithstanding all this, the great stumbling-block (four feet instead of eight) which has choked off the preceding alternatives, would extinguish the idea of connection here also, were it not for the light thrown upon the subject by Von Landois and Löw, through the bristles and warts or stumps of feet that they have seen on the underside of the Phytopti. To appreciate the full import of these observations, we must remember that in the Sarcoptidæ, especially in those truly parasitic species that live under the skin of other animals, there is a tendency to abbreviate and do away with the organs of locomotion, which shows itself now by contracting the length of the legs, again by the almost entire absorption or atrophy of one or more of the pairs, or by reducing them to the dimensions and form of a wart with a bristle proceeding from it. In Sarcopterus nidulans, all eight legs are contracted to mere eminences, from which spring a number of bristles. In Sarcoptes scabiei, the female has each of the four anterior feet terminated by a sucker, but there are none to the four posterior feet, instead of which, each is terminated by a stout bristle. The way in which the legs are in these instances contracted, so as to cease to look like anything more than a wart, while still retaining all the parts of a leg, may be seen in the hind legs of many species of Sarcoptes, *e.g.*, in Sarcoptes squamiferus (S. canis of Hering). In Trichodactylus, and in some Hypopi, the posterior legs are reduced to a long bristle. Our minds are thus prepared for the substitution of a wart, with a bristle springing from it for a regular leg; and when we find that there are four warts with bristles on the underside of the Phytopti, just about where the missing legs should be, one is very apt to accept them as their representatives, without caring very much whether they are only in the shape of a wart and bristle, or the actual "fusstummel" that Von Landois thought he saw. Professor Westwood suggested that the two long bristles at the tail of

CASE XVI.

the Phytopti might be the homologues of the missing legs, but their position is not favourable to that view, and now the discovery of the right number of warts and bristles on or near the right place, gives greater probability to the view first taken by Latreille, that the Phytopti form part of the section Sarcoptidæ. Nor can Dujardin's discernment be passed over without acknowledgment. If his Phytopti belong to the Sarcoptidæ, they are not the less a very distinct and special section of that tribe.

We must not, however, be too confident in the absolute certainty of the above conclusion. All that we can say is, that it seems the most probable solution of the difficulty; but we must remember that the premises are but imperfectly established. The warts and bristles have not yet been observed on all species, nor in every individual. But, on the other hand, we must remember that even although competent observers should fail to find them, they may be sexual, and only present in one sex; or the bristle may be hyaline and not always distinguishable, a thing which, under the most favoured circumstances, must always be of extreme difficulty. Moreover, one positive observation by a reliable witness should carry more weight than a hundred negative ones. And lastly, when the insect is alive it is restless and keeps swaying its head about, so that a confirmed long look at any part of it is impossible. When it is dead the parts become flaccid, and it is still worse, so that while there is plenty of apology for not being able to make out all the parts, that very fact should make us slow to form an opinion, and open to change it should fresh argument or discovery give a new aspect to the case.

There are other puzzling difficulties connected with these mites and with the production of their galls. One of these is, whether the same mite makes more than one kind of gall, or does more than one kind of mischief. We think not; but according to more than one author who has searched for Phytopti, the same species is found in different galls on different plants, and indifferently in galls and in ungalled buds. Dujardin states that he found the

CASE XVI. same species of Phytoptus that he detected in the lime tree nail-gall also in the malformed and distorted buds of the hazel. Dugés found the same mite (or at least what has been supposed and assumed to be the same mite) in a similar gall, or Salix alba, and Siebold found it among the hairs of some species of Erineum, and named it Eriophyes. Now if these were really the same species there would be here a want of that restricted and definite relation between the gall produced, the plant on which it is produced, and the insect producing it, which we have hitherto found to be constant in the relation of gall and gall-maker. An insect that is found at one time in the distorted buds of the hazel, and at another in the galls of the willow leaf, and at a third in the galls of the lime leaf, cannot, one would think, well be the maker of all three. In all cases that we know of, where galls of a special and distinct form are produced, they are invariably the work of some specific insect, told off, as it were, for that special purpose. In other words, the same insect does not make two different kinds of galls, and the same gall is never made by two different kinds of insects, nor on two different kinds of trees, nor does it at one time make a gall and at another time make none: its habits of life are fixed. It is either always a gall-maker or never. On the other hand, as we have seen, the galls made by Phytopti differ somewhat from other galls, and it may be that the same irritation which produces one form of excrescence on one plant may produce another on a different one, through the difference in their constitution; or, it may even produce a gall on one and not on another; but the more probable conclusion seems to be that the observers referred to may have confounded different species.

Another very difficult point of inquiry, especially with a view to preventing or curing their attacks, is to ascertain their habits. How does such an insect which, apparently, is entirely a vegetarian, and depends for its food on the sap of young leaflets or leaves, pass the winter when the leaves are all gone? This we are able to

CAGE XVI.

answer, at least to a certain extent, viz., so far as regards those that live in buds. These have been found already established in November in the young buds of the currant, which are then elaborating for development in spring, but whether they are torpid through the winter or not we do not know, most probably they are. But what becomes of those that live in galls on leaves, and not in buds, and what becomes of some of them, at least between spring, when they are in myriads, and autumn? In summer we see none of the bud species; the buds are gone, destroyed by these creatures—but what becomes of them then? Again, how do they spread? we may assume that they do so very slowly, for although when a tree has once become attacked by these Phytopti it continues to be so year after year, other trees of the same kind standing around it are often perfectly free and untouched. The same circumstance has been observed of other galls; some species of oak-galls having been known for many years to be confined to individual trees, and not to have spread to others at no great distance. This is not without its advantages for observation; anyone who has a tree that is once infested with mite-galls near his house should be able to watch for their very earliest appearance, and study the whole course of their development under the most favourable conditions; and one of the most curious and important of these points must be how these slow-moving, almost stationary animals manage to spread themselves all over the buds of a tree, or over a whole hedge, or to any solitary individual tree. We do not see them moving about during the day, but they may wander at night, the sun's rays might be too strong for such impalpable globules, and dry them up. Anyone who has tried to examine them under the microscope knows how likely this would be. But here again there is a difficulty, they seem incapable of continuing to move in any definite direction for any time. They waggle about in an aimless way, turned from their path by any obstacle, such as meeting one of themselves; and it is difficult to conceive them spreading any distance from the spot where they

CASE XVI.

were hatched, a fact which there is no denying is in favour of the maternal parent being a differently formed animal, with a more active disposition, and better means of indulging it.

The mischief that these creatures do to plants is very considerable. As already said, they attack them in two different ways; one, through the bud, the other through the leaves; of the two the former seems the most injurious. In spring the buds attacked are seen to languish and decay, or to assume a rounded swollen form without pushing out; on tearing a bud open hundreds of minute semi-transparent moving things may, by the help of a lens, be seen between the leaflets; these are the Phytopti, but it takes a good glass to see them at all. The surface of the leaflets on which they are scattered has a moist, raw-like appearance, in fact the Phytopti have browsed on it until they have flayed it to the quick. It is unnecessary to say that these buds produce nothing. When it is the leaves that are attacked, the excrescences or galls of various kinds, of which we have above spoken, are formed upon them. Sometimes the Phytopti are to be found in great numbers inside, and, as already said, in that case the inner surface is free from hairs, unless, perhaps, a few stumps, and looks raw like a galled wound, like the surface of the leaflets in the bud; but more frequently no Phytopti are found in these galls, or, perhaps, it would be more correct to say that in some kinds of plants they are found commonly enough, in others very rarely indeed, and when not present the inside is grown up with hairs.

There remains to say a word as to the nomenclature of these creatures. The galls themselves have received the general denomination of Acarocecidium. Then the different kinds have received different generic names, besides the old botanical names of Phyllerium and Erineum, which have been preserved. As, so far as we yet know, no other genus of mite than Phytoptus is engaged in the production of these galls, we do not propose to follow this nomenclature, further than to note the names when they occur. For us they are all galls of Phytopti, and nothing more.

CASE XVI.

Section I.—Species Living in Buds.

Nos. 1, 2, 3, 4. Phytoptus taxi (Tetranychus taxi, *Murr.*, in Gard. Chron. 1875).—**1.** Sketch of twig with buds attacked by it; **2.** Magnified figure of the insect; **3.** Magnified diagram of section of injured bud; **4.** Microscopic slide containing this section.

This species was first noticed in the spring of 1875 by Professor Thistleton Dyer, who found it doing considerable damage to the yew hedges in the neighbourhood of London, by destroying the young buds and preventing a fresh growth. The buds looked as if they had been frost-bitten, and on breaking them open they were seen to be swarming with Phytopti—so minute, however, as not to be discernible with the naked eye. The texture of the skin of the leaflets in the bud was seen to be injured, and it made no progress. We described it, with doubt, as a Tetranychus, it being at the time we did so, the general opinion that Phytopti were the larvæ of that genus. We are no longer of that opinion.

Nos. 5, 6. Phytoptus coryli (*Frauenf.*, Verh. Zool. & Bot. Gesel. in Wien. xv. 895), (Calycophthora avellanæ, *Amerl.*, Lotos, 1863, p. 44).—**5.** Specimens of twigs with buds attacked by it (2); **6.** Sketch of ditto.

This was first observed by Dujardin (Ann. des Soc. Nat. 1851). It is also not improbable that it is the same as Dr. Amerling's Calycophthora avellanæ, of which Kaltenbach says:—"This mite, according to the observations of Dr. Amerling, M. Kirchner, and ourselves, deforms the leaf buds into cone-shaped scaly galls, which fade early, and never unfold or produce fruit." The buds here are swollen and rounded.

No. 7. Phytoptus persicæ.—**7.** Sketch of twig attacked by this species.

At Montreuil, near Paris, which is celebrated for its cultivation of peaches, the peach trees are at times attacked by a disease, which is known there by the name of "the miller" (le meunier). The disease consists of a sort of white dust, which covers all the peach trees. In 1851 M. Guerin Meneville pointed out (Ann.

CASE XVI. Soc. Ent. France) that this was probably due to innumerable quantities of the larvæ of a mite, which, from his description, can be no other than a Phytoptus. The dust is probably the exuviæ, or cast skins of the vast numbers of this mite.

Nos. 8—11. PHYTOPTUS RIBIS (*Westw.*, Gard. Chron. 1869).—**8.** Specimens of currant buds attacked by; **9.** Sketch of ditto; **10.** Magnified sketch of first stage of mite; **11.** Magnified sketch of next stage.

For some years past the currant bushes in England and apparently still more in Scotland, have suffered much from the de-

Currant buds attacked by Phytoptus ribis.

struction of the immature buds by this species. It is found in hundreds in the buds in spring between the young leaflets that overlap each other, feeding on the sap in them, and causing the buds to shrivel up, thus destroying the future flower or branch. One of the few points beyond the above that we know of their economy, viz., that they are already present in the month of November in the buds forming for next year's crop, suggests close and severe pruning as a likely means of destroying, and, if not extirpating, at least diminishing this pest.

CASE XVI.

Section II.—Species Living in Galls.

Nos. 12—16. Phytoptus tiliæ, which produces the lime-leaf nail-gall (Ceratoneon extensum, *Bremi*).—**12.** Specimen of leaf bearing these galls; **13.** Sketch of ditto; **14.** Magnified sketch of galls; **15.** Magnified section of gall, showing the interior full of hairs; **16.** Magnified figure of the mite, copied from Dujardin's figure.

We have already given a figure of this gall and its maker in illustration of our general remarks. The gall is green when young and then becomes yellowish, and passes successively through red, crimson, purple, into brown. This gall also occurs on the Tilia argentea. There are two or three other mite galls that occur on the leaf of the common lime tree or its allies on the Continent, and may, perhaps, also be found in this country. One is a yellow, red hairy, half-cone-shaped gall, which appears in the angles between the ribs; very rarely elsewhere. On a section being made, it is found to be divided into two, forming a double-roomed house. Another one, very like this, but dark coloured, is also described

There is a fourth species named Legnon crispum by Bremi, which makes a marginal swelling on the leaf; a fifth, which we shall call

Bract of Tilia parvifolia with margin of leaf rolled in by Phytoptus tiliarius
Copied from figure by Löw.

Phytoptus tiliarius, makes knotty, curled-in margins on the bracts of the flower of Tilia parvifolia; and a sixth (Phyllerium tiliaceum, Pers.) which makes little lumps on the under side of the leaf.

Nos. 17—23. Phytoptus aceris (Volvulifex aceris, *Amerling*, which produces Ceratoneon vulgare, *Bremi*, on the leaf of the sycamore).—**17.** Sycamore leaf bearing galls of ditto; **18.** Sketch of ditto; **19.** Sketch of leaf of variegated sycamore (Acer pseudoplatanus, var. Leopoldi), bearing galls of ditto; **20.** Specimen of ditto; **21.** Leaf of sycamore bearing galls on under side, showing the woolly entrance to the gall; **22.** Sketch of ditto; **23.** Magnified section of gall of ditto.

ASE VI. The remarks which we have made as to the extreme rarity of the occasions on which the Phytopti have been observed inside the lime nail-gall apply equally to this gall. Very few people have seen them in it; but still they have been observed. The appearance of the gall on the leaf, and a magnified section of the gall (full of hairs) is shown in the woodcuts. The colour of the gall is bright red carmine or even purple, and when it grows on

Volvulifex aceris produced by Phytoptus.

Section of gall of Volvulifex aceris.

the variegated sycamore (Acer pseudoplatanus, var. Leopoldi), the contrast of the bright carmine galls with the pale yellow leaf is very beautiful and attractive. The Phytopti that are found in these galls are yellowish-white.

PHYTOPTUS MYRIADEUM (Cephaloneon myriadeum, *Bremi*).—**24**. Specimen of leaves of common maple covered with these galls; **25**. Sketch of ditto.

These have usually been considered the same as the preceding gall on the sycamore; but we have little doubt that it is Bremi's species above named, with which it agrees.

CASE XVI. There is another mite gall which is found on the sycamore and various maples. It produces cottony clusters of hairs on

Cephaloneon myriadeum on maple leaf.

the underside of the leaf, and has been named by the older botanists, Erineum acerinum, Pers. The mite that produces it is whitish. Erineum purpurascens is considered by Herr Löw to be distinct from this; Kaltenbach and others think it the same. Another species, named by Bremi Cephaloneon solitarium, is described as growing on the upper side of the leaf in the angles of the ribs.

CASE XVII. Nos. 1—5. PHYTOPTUS PYRI (Typhlodromus pyri, *Scheuten*).—**1.** Sketch of leaf of pear tree bearing galls of ditto; **2.** Specimens of ditto; **3.** Magnified section of gall of ditto; **4.** Magnified sketch of Phytoptus, the supposed larva of Typhlodromus pyri, copied from Scheuten's figure; **5.** Magnified sketch of a Gamasus, supposed by Scheuten to be the perfect form of Typhlodromus pyri.

This is a common affection on the leaves of the pear tree in

CASE XVII. this country. It is also common on the Continent. Kaltenbach in his Pflanzenfeinde tells us that, according to Kirchner, the mite lives on the small yellow shining young leaves, where they cause red swollen places, which later on become dark red and

Pear leaf with galls produced by Typhlodromus pyri.

Section of gall of ditto.

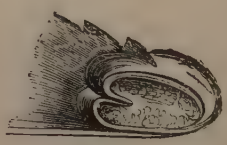
black. On the under-side of the leaf a small hole can be seen with a lens in each of the swellings through which the old mites go in and out. When one cuts through one of these swellings horizontally, the cellular tissue seems to be loosened yellowish and blackish, and between and under the loosened part are found the eggs and mites. We have already given a figure of the latter in speaking of M. Scheuten's observations.

Nos 6, 7. PHYTOPTUS ATTENUATUS (Ceratoneon attenuatum, *Bremi?*).—**6.** Leaves of sloe tree bearing galls of ditto; **7.** Sketch thereof.

This is perhaps the same species as the following, which is entitled to precedence as first described. The gall however is

CASE XVII. smaller, appears more confined to the margin of the leaf than in the plum tree, and is more aggregated and velvety.

Ceratoneon attenuatum on leaves of sloe



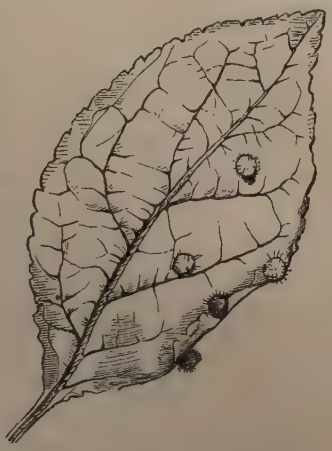
Section of gall on sloe leaf.

Nos. 8–10. PHYTOPTUS PRUNI (Voivulifex pruni, *Amerl.;* Cephaloneon pruni, *Bremi;* Bursifex pruni, *Amer.*).—**8.** Leaves of plum tree bearing galls of ditto; **9.** Sketch thereof; **10.** Magnified section of gall of ditto, showing interior filled with hairs and no mites.

These are galls like purses, made by Phytopti on the under side of the leaves of the plum tree; there soon appears on the upper side little purses or club-shaped galls of the size of a hemp seed, on the outside of which grow Phyllerium and Erineum-like white hairs. The top of the gall is red in the beginning; later it becomes chestnut brown. This Acarocecidium is usually found on the second or third leaf of the twig. Dr. Amerling ("Ges. Aufsätze," p. 159) noticed these galls in Bohemia, but took the gall mites found in them for larvæ of a mite, which he named Bursifex pruni. (See also "Dr. Thomas, l. c. 33, Bd., 1869, p. 330, No. 2.")

CASE XVII. Its appearance is shown in the woodcut. It is common in this country on the plum tree. In Bohemia Drs. Amerling and

Twig of plum tree with galls of Volvulifex pruni.



Leaf of plum tree with galls of Volvulifex pruni.

Kirchner thought that it only appeared there on those trees that were growing old; but there is no such restriction in this country. It is already formed in the month of May, and afterwards becomes harder

Nos. 11—15. PHYTOPTUS SALICIS.—**11.** Leaves of sallow, tree bearing galls of ditto; **12.** Sketch of ditto; **13.** Magnified sketch of leaves with ditto; **14.** Magnified section of gall; **15.** Magnified figure of insect.

The insect in this case is exactly like those found in other galls of this kind, but is not yellowish-white, but a distinct yellowish orange colour, although still pale. The woodcut on page 337 represents the appearance of the leaves when attacked, and a magnified section of the gall itself. This is one of the galls that we have found swarming with the mites, and then there were no hairs or cottony matter growing inside, although appearances of its having grown.

CASE XVII. Many other Phytopti, which are as yet desiderata in the collection, have been described as occurring on the Continent, most of which are no doubt also found in Britain. We may note one or two of the more important of these.

On the Apple Tree.

Erineum mali, *Am.*

This causes hairy spots on apple leaves, described as a cryptogamic growth by the earlier botanists. In these, where the hairs spring, the larvæ of the mites are distinctly to be seen.

Typhlodromus mali, *Am.*

Dr. Amerling found this on the young leaves of the apple tree, in the orchards at Prague. May it not be same as T. pyri?

On the Pear Tree.

Volvellina marginalis, *Am.*

Of this Amerling says, the larvæ move about the edge of pear leaves that are just opening from the buds.

Phytoptus Sp.

A flat pustule, like galls in the parenchyma of the leaf, such as those on the leaves of Sorbus torminalis.

Phytoptus Sp.

The edges of the leaves rolled up sometimes all round the leaf. This rolling has more than one round, is very thick and firmly rolled; the inside quite smooth and shining, the outside somewhat lighter coloured than the leaf, and are for the greater part found on the first leaf in the shoot. It harbours the Phytoptus in small numbers; it is white at first, and then becomes red.

On Cydonia Vulgaris.

Erineum aucupariæ, *Kunze.*

Flat pustules, like galls in the parenchyma of the leaves, which are often like those on the leaves of Pyrus and Sorbus. The entrance to this gall is, as usual, on the under side of the leaf;

CASE XVII. only on leaves such as those of Cydonia and Sorbus, which have a very felt-like underside, have they been found on the upper. The old botanists described these lea. pustules also under the name of Erineum (E. pyrinum, Pers., and E. torminalis, Fée).

On the Thorn.

Erineum oxyacanthæ, *Am.*

Every here and there the edge of the leaf is turned up; underneath it is of a greenish yellow colour. These turned up parts are full of Erineum rust, in which lives a transparent whitish, conical cylindrical mite, $\frac{1}{8}$ of a millimetre in length. The mites appear in May. Besides the thickened edges, they form light-brown egg-shaped bells, and club-like galls.

On the Plum.

Cecydoptes pruni, *Am.*

This, according to Dr. L. Kirchner, produces galls on the young twigs of the plum tree. Dr. Amerling discovered them at Prague, and although they usually only appear on trees that are growing old, and whose death is approaching, Dr. Kirchner has besides noticed them on young and healthy plants, whose death they cause.

On the Vine.

Phyllerium vitis, *Fr.*

This was well known to the earlier botanists. It consists of warty simple or divided transparent spots, scattered over the under side of the leaves of the vine. It may very possibly have in some instances been confounded with the work of Phylloxera vastatrix. The mites that produce it are so small that they can only be seen by means of a strong magnifying glass. They are fully described by Von Landois, to whose papers we have already referred.

A peculiarity in regard to the appearance of this Phyllerium was noticed every year in succession in the botanical garden at

CASE XVII. Vienna, in which large old plants of Vitis vinifera, L., V. vinifera, var. Vesuviana, from Vesuvius; var. Alexandrina, from North Africa; var. Lacrima Christi, from Naples; var. Carinthiaca, from Armenia and Taurus; and vars. Arizonica, Eng. æstivalis, Mich. and cordifolia, Mich., from North America, were trained in espalier on a wall. Of these the Vitis cordifolia, V. vinifera, var. Alexandrina, and var. Lacrima Christi, were not touched by gall mites, whilst the leaves of all the rest were every year covered with Phyllerium spots.

On the ash.

The so-called clusters of the ash. They are the monstrous deformed styles of the flower, which gather into a ball, brownish green at the beginning, later on a dark brown, causing rough masses on the upper part, which have on the outside a great similarity to fragments of the upper part of a cauliflower. Its upper side is clothed, as it were, with colourless hair cloth, from which come stick-like hairs. They are solid, without any hollow space, and, in a dry state so hard, that they can be sawn and cut like wood.

It was until now unknown from whence these Cecidiums derived their origin. The circumstance that they were always found on the same trees and boughs left very little doubt of the gall mites being the author of them, but still certainty was wanted. Herr Löw's researches have now shown that gall mites cause these clusters, and live in great numbers in them. They are almost as clear as glass, and the smallest animals of this family, inasmuch they cannot be seen even with a strong glass. But if a gall is washed in water and examined with the microscope the living mites will be found in the sediment in considerable numbers.

On the Mulberry.

Trichoxyreus, Sp., *Am.*

Dr. Amerling discovered upon the mulberry a new kind of mite,

CASE XVII. of which the larvæ break down the hairy covering of the leaves, and the cells become yellow and scarred through the sucking out of the leaves.

On the Elm.

PHYTOPTUS, Sp.

G. V. Frauenfeld (" Verh. and zool. bot. Ges. Wien., 1865, p. 897 ") without indicating where it was found, described small green, very solid leaf-galls, which stand out like pegs on the upper and under side of the leaves. Very often they are found singly on the first leaf of the shoot, most numerously on the second and third leaves.

PHYTOPTUS, Sp.

Globular purse-shaped galls, pale green in colour, with rather coarse hairs, and very thin walls from 1½ to 2 millimètres in thickness. They are scattered often in great numbers over the upper side of the leaf. The walls are so thin, that the slightest touch leaves an impression, and they can best be compared to a bubble that has not been completely blown. The inside is bare and shining. The entrance to the gall on the under side projects scarcely or not at all beyond the surface of the leaf, and is closed by a loose white Erineum, which is also continued in the gall stalks. The small number of gall mites in it are light brown. This Acarocecidium is occasionally found on the first, but, as a rule, principally on the second leaf of the shoot.

On the Alder.

ERINEUM ALNEUM, *Pers.*

Most frequent on the under side, very seldom on the upper side of the leaf. The gall mite living in it is transparent white.

CEPHALONEON PUSTULATUM, *Bremi.*

Upon the upper side of the leaf. In spring, shortly after the

CASE XVII. buds of the alder unfold, one can see on the still tender leaves already the beginning of these Cephaloneons. It shows as a small round yellow little spot, which has in the middle a green point. On every such spot a gall developes itself in a short time, so that by the middle of May it is already one millimètre in size in which at that time is to be found two to four brownish white Phytopti, $\frac{1}{6}$ of a millimètre in length.

PHYTOPTUS SP.

This species produces blisters of the upper side of the leaf, in the angles of the nerves on both sides of the middle nerve, harbouring a pale honey-coloured cylindrical mite, $\frac{1}{8}$ of a millimètre in length.

It frequently happens that the three above-mentioned mite galls are found on one and the same leaf. Besides these there is:—

PHYLLERIUM ALNIGENUM, *Lnk.*

On the under side of the leaf of Alnus incana.

ON THE BIRCH TREE

ERINEUM BETULINUM, *Schum.*

Very short, spherical, and thickened at the end, like white transparent pegs placed here and there over the surface of the leaves and leaf-stalk, which appears, to the naked eye, to be strewn over with fine white morsels of quartz. The Phytoptus belonging to it is one-sixth of a millimètre long, and transparent white.

ON THE HORNBEAM.

PHYTOPTUS SP.

This species forms crumpled foldings of the ribs of the under side of the leaf, which, according to Frauenfeld, contain no hairy formation. In May a yellowish Phytoptus is to be found in them scarcely one-eighth of a millimètre in length, with two com-

CASE XVII. paratively long bristles at the back. V. Frauenfeld states that he found this Phytoptus at the end of July and August of a reddish-brown colour.

ERINEUM PULCHELLUM, *Schl.?*

Oblong, bare, stool-like dots, more or less raised, on the upper side of the leaf and up in the angles of the rib, and along the mid rib of the leaves, like those already mentioned on the leaves of the alder. They are occasionally but seldom found by themselves on the side of the leaf near the edge between the leaf nerves. They are to be found on the first leaves of the young shoots, are darker coloured than the leaf, and filled inside with a long brownish Erineum, which consists of worm-shaped short hairs, harbouring brownish mites in no great numbers.

PHYTOPTUS CARPINI, *Am.*

This occurs on the side-rib of a leaf, in a fold between which the larvæ live, often in thousands. This is probably the Phytoptus carpini of Frauenfeld (Kirchner).

MALOTRICHUS CARPINI, *Am.*

This mite is found on the underside of the leaves in the axil of the leaf nerve, and causes there a hairy cushion-like formation.

VOLVULIFEX RHODIZANS, *Am.*

Another kind of mite gall appearing on the upper side of the leaves of the Hornbeam, like purses, with carmine-red and rose-red hairs.

ON THE WILLOW.

PHYTOPTUS SP.

Narrow rollings of the edge of the leaf upwards, which resemble those which occur sometimes on the leaves of the pear tree. They extend always only on a short part of the edge of the leaf,

CASE XVII. do not change colour, are quite loosely rolled in the spring, later on harden, and become firm and brittle. Inside there is an abnormal hairy lining; the gall mites living there are of a yellowish colour.

PHYTOPTUS SP.

Pouch-like deformities on a small part of the edge of the leaf of Salix alba, L. The edge of the leaf is for a short extent much drawn out, then much turned up, through which a closed, somewhat swollen pouch appears, which almost always stands on the edge of the leaf, often projecting far over it, rather cartilaginously thickened, wrinkled on the upper side, and usually of a light green colour. This pouch, many of which appear on one leaf, have a very scanty lining of hair, and contain reddish gall mites in small numbers.

PHYTOPTUS SP.

Dr. Thomas described (l. c. 33, Bd. 1869, p. 332, No. 5) similar galls on the leaves of Salix fragilis, L. in the herbarium of Professor A. Braun, which were otherwise furnished inside from those described above, therefore not entirely agreeing with them; they had been before met with and were described (l. c. 39 Bd. 1872, 465,) by him in the Swiss Alps on Salix herbacea, L., from $\frac{3}{4}$ to $1\frac{1}{4}$ millimètres in size.

ON THE POPLAR.

HELIACZEUS POPULI, *Kirch.*

This is one of the mites observed by Dr. Leop. Kirchner: it appears at the petiole, close under the base of the leaf; orange-coloured, of the size of a lentil, with small red wart-shaped galls on Populus tremula.

BATONEUS POPULI, *Kirch.*

These mites are said to be gregarious, living in many-chambered

CASE XVII. greenish-red galls, from the size of a hazel nut to that of a man's fist, on the ground, on the rootlets, and also under the earth, on Populus tremula. This certainly looks much liker the work of some other insect than a mite; but one can hardly suppose Dr. Kirchner to have made a mistake of that kind.

PHYTOPTUS SP.

According to Kaltenbach, this little white mite is invisible to the unaided eye. It lives on the straggling bushes of the aspen. It makes its appearance early; even when the swelling leaf buds throw off their scales and the young twigs with the tender little leaves appear, the numerous mites already begin their attack. They appear on the young twigs, near the axil, then suck the unfolding little leaves at the edge, which thereby get a thickened, crinkled, somewhat rolled-up edge. At last, they lay hold of the surface of the leaf and stop the development. The normal young twigs so encumbered form numerous roundish wrinkled balls, until the leaf is deformed past recognition. They are very crowded round the shortened axil part.

Kaltenbach found these striking monstrosities in the beginning of July on a hedge in a meadow, in a light situation, and by subsequent research noticed also the small originator of the deformation, besides single immature, wingless plant-lice on the healthy leaves of the twigs and between the head of the leaves crawling about, which, he says, had certainly no share in causing the malformation.

ERINEUM POPULINUM, *Pers.*

Flat, pale green (4—10 of a millimetre long and 2—4 broad), elevations of the upper surface of the leaf, the underside filled with an extremely short Erineum, yellowish in the beginning, later of a browner colour, harbouring a Phytoptus $\frac{1}{7}$th of a millimetre in length, rather conical, and reddish. Found on the aspen, but not in large numbers.

CASE XVII.

PHYTOPTUS SP.

This causes a deformity of some of the lateral twigs and leaves of the aspen, at the beginning of a reddish colour, later, however, spotted with black, very striking, even at a distance. Dr. Thomas (l. c. 33, Bd. 1869, p. 341, Anm. 17) calls them remarkable rollings and crinklings of the leaf. Such lateral twigs are shortened, the leaf-stalk extraordinarily drawn near to one another, and the leaves wrinkled beyond recognition, the edges in various ways, either turned up, wrinkled, or rolled back to the middle of the leaf. On many of these deformed lateral twigs, which are often pyramid-shaped, one or more normal leaves may be found at the base; however, almost all the leaves on such a lateral twig are attacked. This bare Acarocecidium is full of numerous Phytopti.

ON THE WALNUT.

PHYTOPTUS SP.

Numerous brownish-red galls, about one millimetre in diameter, are scattered in the parenchyma of the leaves, and project on both sides; beneath they are somewhat more wart-shaped, so that their height is about $1\frac{1}{2}$ millimetre. The outside is not hairy, rather rough, and uneven, the inside is filled with loose parenchymatic cellular tissue, in which a gall mite lives in astonishingly large numbers. The entrance to the gall is on the underside bare and narrow. The Phytoptus which lives in this gall measures about one-sixth of a millimetre, and is either of a brownish or yellowish colour.

ERINEUM JUGLANDINUM, *Pers.* (Erineum juglandis *Ung.* Phyllerium juglandis, *Schleich*).

Oblong, the surface of the leaf strongly raised between the side nerves, underneath a short first white, then brown, Erineum, in which the gall mites live.

CASE XVII.

On the Horse Chestnut.

Erineum æsculi, *Endl.* (Phyllerium axillare, *Opiz.*)

Small, brown, roundish, oblong tufts of hair on the underside of the leaves, in the angles of the nerves. Kirchner described these tufts of hair ("Lotos," 1863, p. 47), but took the gall mites found in them to be the larvæ of a mite which he called Phyllereus hippocastani.

On the Oak.

Erineum quercinum, *Pers.*

On the leaves of the Turkey oak. Round or oblong, more or less raised portions of the surface of the leaf, of very various thickness, and on different places on the leaf, of the same colour as it, or, when older, somewhat yellow or brownish colour. They are to be found on the first leaf of the twig, and are inside, that is to say underneath, filled with a moderately long but thick growth of hair, white at first, then reddish brown, out of which come five different kinds of hair, long, curled, pointed, awl-shaped, and short thick sausage or club-shaped. In rare cases, little spots of this hairy growth are found on the upper side, without the remarkable raising up underneath on the leaf stalk. On searching this deformity, its author was found to be Phytopti, which were here almost of one thickness, cylindrical, and of a pale wine yellow colour. The Erineum quercinum, *Pers.*, therefore, belongs, like all the other Phylleriacia that have been examined, to the gall mites. It is confined to Quercus cerris; for trees of Quercus cerris, L. pedunculata, *Ehr.*, and sessiliflora, *Sm.*, were growing close to one another, and this Acarocecidium was only to be found on Quercus cerris.

On the Beech.

Phytoptus Sp.

Galls resembling little brown tufts of hair in the angles of the ribs, on the underside of the leaf, like those which have been

CASE XVII. described on the maple and horse chestnut. They consist of long pointed hairs, which agree with the normal hairs of the bearded angles of the leaf nerves in appearance and colour. Upon the upper side of the leaf a scarcely perceptible raising of the lamina shows the presence of such hair tufts. Dr. Löw found Phytopti in these.

LEGNON CIRCUMSCRIPTUM, *Bremi.*

A very narrow rolling of the edge of the leaf on the upper side, almost all the way round. It begins in May, when the leaves of the beech are still tender and long, and deeply notched at the edge. Through the rolling up of the edges, the notches are rolled in with it, and these are the only vegetable contents of the roll, which soon appears thickened and cartilaginous.

ON THE SCOTCH FIR.

PHYTOPTUS SP.

These are bark galls described by Von Hartig ("Forstl. Conversat.," Lex. II., Aufl. 1836, p. 737), which are filled with exceedingly numerous gall mites. They are dirty white, almost equally thick and cylindrical, $\frac{1}{4}$ millimetre long, having a remarkably long snout, out of which they can stretch the piercing apparatus far.

ON CLOVER AND OTHER PAPILIONACEOUS PLANTS.

VOLVELLA CORONILLÆ, *Am.*

The larvæ of these mites live between the close clapped pinnæ, and by these means, the little misformed leaves get a pod-like appearance. Kaltenbach states that he has noticed similar deformations, in consequence of the sucking mites, in Vicia sepium, and Trifolium repens.

CASE XVII.

On the common Strawberry.

Phytoptus Sp.

By this species spherical short and thickly-haired purple red galls, at the most 1½ millimetre in size, are produced in such numbers on the upper side of the leaf, that the whole surface of the leaf seems to be covered with them. The entrance to the gall on the underside is small and somewhat hairy. Inside are some single scattered short pegs, no doubt remains of hairs, but with no actual hairs. The gall mite living in it is yellowish.

On Salvia pratensis.

Phytoptus Sp.

Kaltenbach mentions that in the middle of July he found galls on the lower leaves of Sylvia pratensis, which appeared sometimes as simple, sometimes as groups of galls. They appeared both on the upper side of the leaf, and on the edge. The gall is puckered, uneven, and very convex, and the under aperture is covered with white felt. Of mites, he says that he only found one small larva between the inner hairy coverings.

Frauenfeld, in 1865, in the "*Verhandl. Zool. Bot. Gesellsch in Wien*," describes the following additional species, viz., Phytoptus granulatus, campestricola, and euonymi. And in the same journal, in 1869, vol. xix., a species found on Bromus erectus.

Thomas gives an account of the mischief done by different species in Switzerland (1869 and 1871).

In America, Dr. Shimer found what was obviously a Phytoptus on the leaves of the white maple, and made a new genus for it, which he called Vasatis.

Another aid to the study of these gall-making mites remains to be tendered. Many cryptogamic growths on leaves are so like the work of insects, that those who are unacquainted with them are very apt to be deceived by them. We have constantly such

CASE XVII. specimens sent to us to know what insect has done the mischief We have therefore appended two or three examples of these at the termination of the mite galls, and it may be advisable at some future time to display a larger collection of them. In the meantime, the following will serve to put the student on his guard.

No. 16. ERINEUM TILIÆ.—**16.** Specimen on leaf of lime tree.

A small woolly patch in the corners between the ribs on the underside of the leaf of the lime tree. It is somewhat like the work of Phylloxera vastatrix on the underside of the vine leaf. It does not appear, however, to be the work of an insect; nor is it a fungus, but is merely an instance of hypertrophy, or overgrowth on the leaf.

Nos. 17, 18. ÆCIDIUM ABIETINUM.—**17.** Specimen of leaf of Abies Cephalonica, bearing open cells of Æcidium on its underside; **18.** Magnified sketch of ditto.

This is a fungoid growth, which occasionally occurs on the leaves of fir trees.

Nos. 19, 20. RŒSTELIA LACERATA.—**19.** Hawthorn leaf, with cells of Rœstelia lacerata upon it; **20.** Magnified sketch of ditto.

This is another fungoid growth, and looks like a congregation of the cells of a Zoophyte. It is confined to the hawthorn, and is not uncommon on its leaves.

Nos. 21—24. RŒSTELIA CANCELLATA.—**21.** Specimens of pear leaves, showing first stage of growth of this fungus, making the leaves look beautifully mottled with orange, **22.** Sketch of ditto; **23.** Leaves of ditto, showing second stage of growth, as seen on the upper side; **24.** Ditto on showing ditto from the underside.

The illustrations in the case show the different appearance of the pear leaves at the different stages of growth of this fungus. It is said to be another form of Podisoma sabinæ, which is found in orange-coloured jelly-like masses on Juniperus sabina.

CASE XVIII.

ANOPLURA (Lice).

The natural transition from the Acari or mites, is to the Anoplura or lice. The step, however, is a wide one. It is from the spiders to the true insects, from the eight-legged to the six-legged class, and a good deal of the apparent affinity or similarity of habit between the two is not real affinity, but mere coincidence in power and place of annoyance. Entomologists have felt difficulty in deciding to what class of insects the lice most nearly belong, and the majority have placed them apart as an independent order. Theoretically, we prefer the views of those who place them among the Hemiptera or Bugs, although practically it is more convenient to treat them as one of the sections of the Aptera. Like the bugs, they have no true metamorphosis, and the points on which they differ are all capable of reconciliation with affinity with them. They have no wings; but the females of the scale insects (which are Hemiptera) are also wingless; one difficulty which has puzzled some is, that those lice that feed on the blood of animals have, as is most fit they should, a sucking apparatus instead of jaws or mandibles, while those that feed on feathers or hair have mandibles, so that systematists, of whom we speak, have been driven to break up the order into two, and carry the sections with different feeding apparatus into different orders standing wide apart. It is well known, however, that all the parts of the mouth of an insect, whether they be adapted for cutting, grinding, biting, or sucking, are all modifications of the same parts. We therefore are not influenced by this adaptation of structure to purpose to separate insects which in all other respects are so obviously closely related to each other. We take the biting species as exceptional deviations for the sucking ones.

These insects are parasitic on vertebrate animals, to which they are confined. As just said they consist of two groups, one of which (Mallophaga), feeds on the hair and feathers of the animals on which they live, for which purpose they are provided with

CASE XVIII. mandibles, and are principally, although not entirely, confined to birds. The other (Hæmatopina) subsists on the blood of the animals they infest, for which purpose they have the usual sucking apparatus of the Hemiptera. These are restricted to mammals.

We left off the parasitic mites at the feather-eating species, and we naturally commence the lice with the species having similar habits.

For the most part these insects have two simple eyes, but sometimes, as in Gyropus, they are without any. The antennæ vary even in the same genus, but the tarsi and claws are constant, and furnish the best characters for dividing the family into groups. We have accordingly given figures of the different variations in these.

Family MALLOPHAGA (Feather and Hair Eaters).

The name of this section was given to it by Nitzsch with reference to their food, and is derived from the Greek word μαλλος, a fleece, and φαγω, I eat. It has been subdivided into several genera depending upon the form of the antennæ, and the number of joints composing them, &c.

Sub-family LIOTHEIDÆ (*Burm*).

Antennæ four-jointed, mouth with strong mandibles. This sub-family is divided into two sections; the one with one claw to the tarsi (genus Gyropus—the louse of the guinea pig), and the other with two claws, containing among others the following, viz. :—

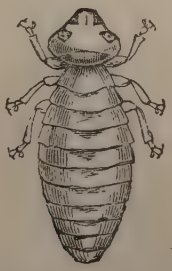
Genus MENOPON (*Nitzsch*).

Head semilunar or trapezoidal. No deep sinuosity on the lateral margin.

Nos. 1—3. MENOPON PALLIDUM (*Nitzsch*).—1. Specimen of ditto; 2. Enlarged figure of ditto; 3. Illustrative vignette (cocks and hens).

Domestic poultry seem to have more than their fair share of

CASE XVIII. annoyance from parasites. We have seen how they suffer from the Dermanyssus avium, the Argas reflexus, the Sarcoptes mutans, probably from Dermaleichi also, and now we find that they have



Menopon pallidum (from the fowl).* ½ to ⅔ of a line in length.

a disproportionate allowance of lice, no less than five species being allotted to them. This is the first and commonest of the five, and few fowls are to be found free from them. Indeed they often swarm among the feathers to such a degree, that the hands of those that rear them cannot be kept free from them when the fowls are plucked or even lifted up. They cling very tightly, and are not easily brushed away, as their bodies are smoothly polished and offer scarcely any resistance.

Nos. 4–6. MENOPON PERDRICIS (*Denny*).—**4.** Specimens; **5.** Enlarged figure of ditto; **6.** Illustrative vignette (partridge).

Infests the partridge, but specimens are also taken on the pheasant.

Nos 7–9 MENOPON FULVO MACULATUM (*Denny*).—**7.** Specimens; **8.** Enlarged figure of ditto; **9.** Illustrative vignette (quail).

Infests the quail.

* Where not otherwise stated the figures of Anoplura are copied or reduced from the magnified figures in Denny's Anoplura.

CASE XVIII.

Genus TRINOTON (*Nitzsch*).

Head triangularly rounded, with a deep sinuosity on lateral margin.

Nos. 10—12. TRINOTON LURIDUM (*Nitzsch*).—**10.** Specimens; **11.** Enlarged figure of ditto; **12.** Illustrative vignette (ducks).

Trinoton luridum, from the duck. 2 lines in length.

Anterior leg of ditto.

Infests various wild ducks, besides the domestic species.

Sub-family PTILOPTERIDÆ (*Burm.*).

Antennæ five-jointed; mouth with strong mandibles.

Genus DOCOPHORUS (*Nitzsch*).

The most notable character by which this genus is distinguished is a small movable projection or tooth called a trabecula in front of the antennæ, as shown in the woodcut. The only other genus in which this occurs is Nirmus (which has so many other points of coincidence with Docophorus that we should prefer their being consolidated into one genus); in Nirmus the trabeculæ are sometimes, but not always, present; but when present they are very small and rigid. Nearly all the species of

Head of Docophorus semisignatus (from the carrion crow), to show the trabeculæ.

CASE XVIII. Docophorus are characterised by two dark-coloured lines, which pass diagonally from the trabeculæ to the occiput, and by the segments of the abdomen having a dark-coloured triangular or oblong patch on each side, which very rarely meet in the centre.

DOCOPHORUS ICTERODES (*Nitzsch*).

Common on ducks, geese, teal, &c.

Docophorus icterodes (from the duck, goose, &c.). $\frac{1}{9}$ line in length.

Genus NIRMUS (*Nitzsch*).

Distinguished from Docophorus by the absence of trabeculæ, or, if they are present, by their small size and immobility. Mr. Denny, however, admits that while these are admirable diagnostic signs for the extreme species at the opposite ends of the line, still there are some which have minute trabeculæ which belong to the debatable ground between the two genera, and that it is extremely difficult to decide to which genus these should be referred.

Nos. 13—15. NIRMUS CAMERATUS (*Nitzsch*).—**13.** Specimens; **14.** Enlarged figure of ditto; **15.** Illustrative vignette (black cock and grey hens).

Infests the black cock and grouse.

Nos. 16—18. NIRMUS CLAVIFORMIS.—**16.** Specimens; **17.** Enlarged figure of ditto; **18.** Illustrative vignette (carrier pigeon).

Infests pigeons.

Nirmus claviformis (from the pigeon). $\frac{1}{4}$ to $\frac{1}{3}$ of a line in length.

Genus GONIOCOTES (*Burm.*).

Head large; posterior margin triangular on each side; abdomen broad, no trabeculæ.

CASE XVIII. Nos. 19—21.

Goniocotes hologaster (from the domestic fowl). 1¼ line in length.

GONIOCOTES HOLOGASTER (*Nitzsch*).—**19.** Specimens; **20.** Enlarged figure of ditto; **21.** Illustrative vignette (fowl dusting itself).

Infests the domestic fowl. The subject of the vignette, a fowl dusting itself, is an alleviative of nature against vermin, adopted by the bird to dislodge and shake them off.

Genus GONIODES (*Nitzsch*).

Head large; temporal angles prominent and acute; antennæ in males cheliform; no trabeculæ; abdomen very broad and flat.

Nos. 22—26.

Goniodes falcicornis (mature). 1¼ to 2 lines in length.

GONIODES FALCICORNIS (*Nitzsch*).—**22.** Specimen of the young insect; **23.** Enlarged figure of ditto; **24.** Specimens of the mature insect; **25.** Enlarged figure of ditto; **26.** Illustrative vignette (peacock).

Infests the peacock. The young differs considerably from the full-grown insect.

Nos. 27—29.

GONIODES STYLIFER (*Nitzsch*).—**27.** Specimens; **28.** Enlarged figure of ditto; **29.** Illustrative vignette (turkey).

Infests the turkey.

Nos. 30—32.

GONIODES NUMIDIANUS (*Denny*).—**30.** Specimens; **31.** Enlarged figure of ditto; **32.** Illustrative vignette (guinea fowl).

Infests the guinea fowl.

Nos. 33—35.

GONIODES COLCHICI (*Denny*).—**33.** Specimens; **34.** Enlarged figure of ditto; **35.** Illustrative vignette (pheasant).

Infests the pheasant.

CASE XVIII. Nos. 36—38. GONIODES DISSIMILIS (*Nitzsch*).—**36.** Specimens; **37.** Enlarged figure of ditto; **38.** Illustrative vignette (domestic cock).

Goniodes dissimilis (from the domestic fowl). 1⅛ line in length.

Anterior leg of ditto.

On the domestic fowl; not common.

Nos. 39—41. GONIODES TETRAONIS (*Denny*).—**39.** Specimens; **40.** Enlarged figure of ditto; **41.** Illustrative vignette (grouse).

Goniodes tetraonis (from the grouse). 1 to 1⅛ line in length.

Common both on the black cock and grouse. This is the insect that sometimes, especially in bad seasons, does so much harm to the young grouse when they are feeble and unhealthy.

Genus LIPEURUS (*Nitzsch*).

Body long and slender, and legs usually very long. It has in the antennæ of the male a little of the character of Goniodes, the third joint being slightly recurved. The greater breadth of that genus, however, with its large and emarginate head and more pronounced antennæ, readily distinguish them.

Antennæ of male Lipeurus, to show the recurved third joint.

Nos. 42—44. LIPEURUS STELLARIS (*Denny*).—**42.** Specimens; **43.** Enlarged figure of ditto; **44.** Illustrative vignette (pigeons).

Infests pigeons (rock dove, stock dove, and turtle dove).

CASE XVIII. Nos. 45—47.

Lipeurus variabilis (from the fowl). $\frac{3}{4}$ to 1 line in length.

Lipeurus squalidus (from the duck). $\frac{1}{2}$ to $1\frac{1}{2}$ line in length.

LIPEURUS VARIABILIS (*Nitzsch*).—**45.** Specimens; **46.** Enlarged figure of ditto; **47.** Illustrative vignette (newly hatched domestic chickens).

Infests the domestic fowl.

LIPEURUS SQUALIDUS (*Nitzsch*).

Infests the duck.

Nos. 48—50. LIPEURUS JEJUNUS (*Nitzsch*).—**48.** Specimens; **49.** Enlarged figure of ditto; **50.** Illustrative vignette (geese).

Infests the goose.

Nos. 51—53. LIPEURUS POLYTRAPEZIUS (*Nitzsch*).—**51.** Specimens; **52.** Enlarged figure of ditto; **53.** Illustrative vignette (teal).

Common on the turkey. "Their mode of progression," says Mr. Denny, "is rather singular as well as rapid. They slide, as it were, sideways, extremely quick from one side of the fibre of a feather to the other, and move equally well in a forward or retrograde direction, which, together with their flat, polished bodies, renders them extremely difficult to catch or hold." He has observed, he also remarks, "that when two or more genera infest one bird, they have each their separate localities, for while the Goniodes stylifer will be found on the breast and neck of the bird, the Lipeurus polytrapezius will be congregated in numbers on the webs and shafts of the primary wing feathers."

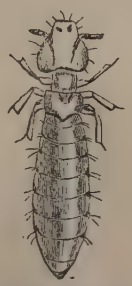
Genus ORNITHOBIUS (*Denny*).

Scarcely differing from Nirmus, except in having two horns to the clypeus.

CASE XVIII. Nos. 54–56.

ORNITHOBIUS CYGNI (*Linn.*).—**54.** Specimens; **55.** Enlarged figure of ditto; **56.** Illustrative vignette (whistling swan).

Infests the swan.



Ornithobius cygni (from the swan). 2 lines in length.

CASE XIX.

Sub-family TRICHODECTIDÆ.

This sub-family differs from the other Mallophaga or bird-lice, in attacking mammals. Its species are all restricted to them, as all the other genera of the Mallophaga are to birds. It contains only two genera, Trichodectes (the form found in Britain), and Gyropus, which is found on the sloth and cavies (South American mammals).

Genus TRICHODECTES.

Antennæ three-jointed, and tarsi with only one claw.

Nos. 1–3.

TRICHODECTES SIMILIS (*Denny*).—**1.** Specimens; **2.** Enlarged figure of ditto; **3.** Illustrative vignette (red deer).

Infests the red deer.

Nos. 4–6.

TRICHODECTES LONGICORNIS (*Nitzsch*).—**4.** Specimens (4); **5.** Enlarged figure of ditto; **6.** Illustrative vignette (fallow deer).

Not uncommon on the fallow deer, and found in greatest numbers on the inner side of the thigh.

Nos. 7–9.

TRICHODECTES SPHÆROCEPHALUS (*Nitzsch*).—**7.** Specimens; **8.** Enlarged figure of ditto; **9.** Illustrative vignette (sheep).

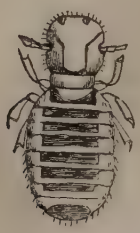
Trichodectes sphærocephalus (from the sheep). $\frac{1}{2}$ of a line in length.

Posterior leg of ditto.

Found on sheep; not common.

CASE XIX. Nos. 10—12. TRICHODECTES SCALARIS (*Nitzsch*).—**10.** Specimens; **11.** Enlarged figure of ditto; **12.** Illustrative vignette (cow).

Common upon cattle, and also found on the ass.



Trichodectes scalaris (on the ox). ½ line in length.

Trichodectes equi (on the horse), 1 line in length.

Nos. 13—15. TRICHODECTES EQUI (*Linn.*)—**13.** Specimens (eggs and insects); **14.** Enlarged figure of ditto; **15.** Illustrative vignette (horse).

Common on the horse and ass, especially when fresh from pasture—in other words, when the parasites have had time to propagate undisturbed by the currying comb.

Nos. 16—18 TRICHODECTES LATUS (*Nitzsch*).—**16.** Specimens (4); **17.** Enlarged figure of ditto; **18.** Illustrative vignette (spaniel).

Trichodectes latus (on the dog). ½ to ⅔ line in length.

Infests the dog, and is commonest on puppies. The male of this species in walking curves back its antennæ.

Nos. 19—21. TRICHODECTES SUBROSTRATUS (*Nitzsch*).—**19.** Specimens (4); **20.** Enlarged figure of ditto; **21.** Illustrative vignette (cat).

Infests the cat on the Continent; not yet recorded in Britain.

Family HÆMATOPINA. (Blood-suckers.)

Antennæ with five joints; mouth with a fleshy sucking apparatus.

CASE XIX. Like the preceding section, this also has derived its name from its food, viz. from Greek word *αἷμα*, signifying blood. The genera belonging to this section are few, and so far as known have five joints to the antennæ, and only one claw to the tarsi.

Genus HÆMATOMYZUS (*Piag.*).

Head rostrate; antennæ lenticular; legs moderate in thickness.

Nos. 22—24. HÆMATOMYZUS ELEPHANTIS (*Piaget*, Tijdschr. voor Ent., 2d Ser. iv. 254). —**22.** Specimens; **23.** Enlarged sketch of ditto; **24.** Illustrative vignette (elephant).

Texture of skin hard and chitonous, antennæ lenticular five-jointed, head with a long slender rostrum like that of an *Apion* but less curved, body ovate and convex on the back, scutellum broad and narrow, tarsi with only one claw.

Colour reddish madder brown, smooth and shining, impunctate.

Infests the elephant.

Hæmatomyzus elephantis 1½ line in length.

Genus HÆMATOPINUS (*Leach*).

Head not rostrate; legs thick.

This is the principal genus that is parasitic on mammals. With the exception of the preceding insect taken on the elephant, it includes all the blood-sucking lice that attack mammals other than man. Those that attack man have been separated from the rest, but in truth cannot well be separated, especially when regard is had to the louse of the monkey, which is excessively like that of the human species, and indeed forms a transition between them and the other species of this genus.

They leave the body much sooner after death than the mallophagous species, which adhere to the feathers or fur for days.

CASE XIX. Nos. 25—27. HÆMATOPINUS ACANTHOPUS (*Burm.*).—**25.** Specimens (2); **26.** Enlarged figure of ditto; **27.** Illustrative vignette (field mouse).

Infests field mice.

Nos. 28—30. HÆMATOPINUS SPINULOSUS (*Burm.*).—**28.** Specimens (eggs and insects); **29.** Enlarged figure of ditto; **30.** Illustrative vignette (brown rat).

Infests the brown rat.

Nos. 31—33. HÆMATOPINUS VENTRICOSUS (*Denny*).—**31.** Specimens (2); **32.** Enlarged figure of ditto; **33.** Illustrative vignette (rabbit).

Infests the rabbit.

Nos. 34—36. HÆMATOPINUS LYRIOCEPHALUS (*Burm.*).—**34.** Specimens (2); **35.** Enlarged figure of ditto; **36.** Illustrative vignette (hare).

Infests the hare.

Nos. 37—39. HÆMATOPINUS SUIS (*Leach*).—**37.** Specimens (3); **38.** Enlarged figure of ditto; **39.** Illustrative vignette (sow).

This species, says Mr. Denny, is found in great abundance on swine; but it does not appear so generally spread as might be

Hæmatopinus suis (on the sow). 1¼ to 1¾ line in length.

Anterior leg of ditto

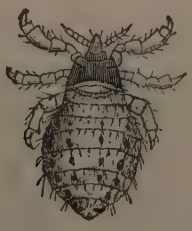
expected from the dirty habits of the animals. It most frequently occurs on those freshly imported from the Sister Isle. It was many months before he could obtain a single example. He had

CASE XIX. applied to both farmers and their butchers, neither of whom seemed to approve the idea which he had conceived of their pigs being lousy, but referred him to those of the Emerald Isle as being sure to gratify his wishes, forgetting that the Irish pigs come to this market to meet English buyers. He accordingly visited a colony just arrived, when he most certainly met with a ready supply; but here they were confined almost entirely to lean animals, and wherever he found a pig fat and healthy, no parasites were to be seen. In walking, this species uses the claw and tibial tooth with great facility, which act as finger and thumb.

Nos. 40—42. HÆMATOPINUS VITULI (*Linn.*).—**40.** Specimen; **41.** Enlarged figure of ditto; **42.** Illustrative vignette (calf).

This is said by Denny, in his great work on this subject, to have been taken only on the calf. It seems, however, very unlikely that a particular species could be restricted to the young of any animal; but the figure given by Denny is too unlike that of the ox (H. eurysternus) to allow us to suppose it an abnormal or exceptional variety of it.

Nos 43—45. HÆMATOPINUS EURYSTERNUS (*Nitzsch*).—**43.** Specimens (several); **44.** Enlarged figure of ditto: **45.** Illustrative vignette (cattle).



Hæmatopinus eurysternus (on the ox), 1 to 1½ line in length.

Infests the ox, and seems to be especially troublesome on the

CASE XIX. mane and shoulder, which are often rubbed bare in the efforts of the animal to get rid of its irritating parasite.

There is an allied species (H. tuberculatus, Burm.) that occurs in Italy on the buffalo. M. Lucas gives a description and figure of it in the Ann. Soc. Ent. Fr., 2nd ser., x. 531.

Nos 46—48. HÆMATOPINUS ASINI (*Linn.*).—**46.** Specimens (4); **47.** Enlarged figure of ditto; **48.** Illustrative vignette (ass).

Infests the ass.

Nos. 49—51. HÆMATOPINUS PILIFERUS (*Burm.*).—**49.** Specimens (4); **50.** Enlarged figure of ditto; **51.** Illustrative vignette (dog).

Infests the dog.

When the dog tick, Hæmatopinus piliferus, establishes itself on a dog, it is apt to be extremely troublesome, being very difficult

Hæmatopinus piliferus (on the dog). 1 to 1½ line in length.

to get off its hairs, and harbouring in its bedding, and almost defying all attempts at destruction. White precipitate, or ammoniated chloride of mercury, the preparation used for cleaning off lice from the human patient, applied in the form of ointment well rubbed in, and afterwards well washed off with soap and water, is the best solid substance for this purpose, and a very weak solution of nitric acid answers well as a liquid. But in both cases the dog must be muzzled to prevent it from nibbling at its fur, and thus imbibing some of the poison. It is ashy flesh-coloured, with a slight chequering. The skin is so transparent that the food (the blood) shines through its skin, and

CASE XIX. the intestines can plainly be seen of a dull red colour. This species has also been taken on the ferret.

Nos. 52—54. HÆMATOPINUS QUADRUMANUS (*Murr, n. sp.*).—**52.** Specimens (4); **53.** Enlarged figure of ditto; **54.** Illustrative vignette (monkey).

From a species of Ateles.

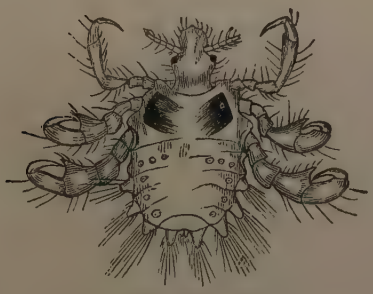
Monkeys are notoriously lousy creatures, as any one may convince himself by entering a monkey-house, where he is sure to see one or more of them busily engaged in searching for vermin amongst the fur of their companions, and eating the captured prey. The specimen here figured was taken from a species of Ateles (a prehensile tailed monkey from South America), and it will be seen that it has many points of resemblance with the Pediculus humanus.

Hæmatopinus quadrumanus. 1 to 1½ line in length.

Genus PHTHIRIUS (*Leach*).

The genus Phthirius is a very distinct and peculiar one, the essential character of which is that the grasping or scansorial claws are on the hind feet instead of on the fore feet as in the Pediculus.

CASE XX. Nos. 1, 2. PHTHIRIUS INGUINALIS (crab louse).—**1.** Specimens; **2.** Enlarged figure of ditto.



Phthirius inguinalis. ½ to 1 line in length.

Scansorial claw of ditto.

CASE XX.

This species confines itself to the hair on other parts of the body than the head. It is the only species of Phthirius that has been described. Other species or varieties may, however, exist, for a parasite is spoken of as infesting the eyelashes of some of the natives of the East Indies, but it has never been described, although it may only be this species, as, from the following account, which we quote from Denny's Anoplura, it also would appear to infest the eyes in persons on whom it has established itself.—"The accompanying insects were sent to me by a lady whom I attended for some years in Devonshire. The following is a slight sketch of her case: She was about fifty years of age, spare in person, of a highly susceptible temperament, and long subject to disordered digestion: suffering from severe headaches, attended by biliary vomiting, and often followed by boils on or about the head. After a time, she informed me that she had been for some time troubled by insects coming apparently from the natural orifices of the body and infesting the surface, particularly when warmer than usual. She complained especially of the annoyance caused by their presence in her eyes and ears. She said that they were often numerous in her throat, and that they were more than once discovered adhering to matters ejected from the stomach, after having been for some time troubled by these parasites. They did not make any permanent lodgment on the surface, from which they were stated to be at times removed in great numbers: nor did they get among the hair of the head. The lady was a person in whose veracity I had much confidence, very intelligent, well-informed, and religious. Her statement was in all its parts confirmed by a young woman who lived with her partly as servant, partly as companion. She said that being now and then called upon to sleep with her mistress, she was at such times greatly tormented by these insects, which she caught in numbers on her skin, but which had no tendency to continue or to breed there. The only parts on which I ever saw them myself were the inner angles of the eyes, on the tarsal

CASE XX. conjunctiva, and in the ears. The application of those external remedies, which readily destroy the common species of Pediculi, failed entirely in extirpating these: a variety of internal means were likewise used unavailingly, and the insects were not admitted to be sensibly diminished in number at the time of my quitting Devonshire."

The reader, no doubt, recollecting what we have already said on some of the acaroid diseases, will be able for himself to eliminate from the above what is essential, and what is doubtful, irrelevant, and accidental. Such cases only occur in private practice, and usually in the country. If the lady had been brought to a London hospital, we would undertake to say that everything mysterious would immediately have vanished, and the patient would have been discharged cured in a week.

Genus Pediculus (*Linn.*), True Lice.

No one can examine the figures of the Hæmatopini above given without seeing that they are exceedingly close to the Pediculi, so much so that that of the monkey might almost be equally well placed in either genus. We need not discuss whether more than one genus should be made for them, but a more interesting question, viz., whether different species of lice are appropriated to different races of men, can hardly be passed over without a word or two of consideration. The interest of the point lies in its bearing on another vexed question, the unity of the human race, on which it may throw some light. On the one hand it is maintained by those who are of opinion that all men are not of the same species that the parasites which infest the different races of man are distinct; and because we usually find that distinct species of parasites are allotted respectively to the different species of the lower animals, they infer that the same rule must hold with man, and that therefore each different race possessing a distinct parasite must be a distinct species. Their opponents, on the

CASE XX. other hand, deny the fact that these parasites are distinct, asserting that one and the same species of Pediculus, and no other, infests all the races of man in every quarter of the globe; and I believe they add, that, even although they were found to be distinct, the inference thence drawn is neither necessary nor warranted.

The enquiries, the chief results of which are displayed in this Case, were undertaken for the purpose of ascertaining what the facts, in this respect, really were. Specimens were got from different races all over the world, and the result of the examination was published in a paper that we read to the Royal Society of Edinburgh a number of years ago (1861). That result was to leave the matter very much as it was before. It proved sufficiently that there were differences between the parasites of different races. They differ in colour according to the colour of the people they inhabit. Those of the West African and Australian are nearly black; those of the Hindoo, dark and smoky; those of the Africander and Hottentot, orange; those of the Chinese and Japanese, yellowish brown; of the Indians of the Andes, dark brown; of the Digger Indians of California, dusky olive, and those of the more North American Indians near the Esquimaux, paler, approaching to the light colour of the parasites of the European. Difference in shape is not so easily made out, for

Claw of Pediculus capitis, from European.

D..to, from Indian of Andes

the body being soft allows considerable variation, but there is considerable difference in size, and also some in the proportions

CASE XX. of the hard parts, such as the claws, and especially in their teeth.

In some, as in those from the European, the Caffre, and the Japanese, the teeth are scarcely visible. In others, from the Hindu, Indian of the Andes, &c., they are numerous, large, and almost tubercular. In others, from the negro and King George Sound Australian, they are limited to two or three well-marked serrations. The form and proportions of what may be called the thumb, are also different. In some, as the Mozambique Africander, Californian Indian, and Indian of the Andes, it is excessively developed; in others, as the European, the Japanese, and Australian, only moderately so. The form of the penultimate joint also varies to a very considerable extent, in some being long, narrow, elongate and straight; while in others it is conical, curved, short, and broad at the base.

But then comes the question, what is the value of these differences as bearing upon the unity of the human species? It has been proved that there are differences, and that these differences are constant and permanent—that is no doubt something, But, unluckily, these differences are most singularly similar to the differences in the races whose unity is the question in dispute,

Claw of Pediculus capitis, from North American Indian of Slave Lake.

Ditto, from Australian.

and to solve which this evidence has been adduced. If we cannot believe that the negro is a different species from the European,

CASE XX. on account of his being black instead of white, neither should we believe that the Pediculus of the Negro is different from that of the European because it is black instead of white. If we cannot believe that the Australian is different from the Esquimaux because he has proportionally a much longer leg, neither can we believe that the Australian Pediculus is different from the Slave Lake Pediculus, because it has a longer and straighter penultimate joint to its tarsus. If the curved tibia of the African does not constitute him a different species from races with straight tibias, neither should the greater or less curvature of the joints of the tarsi in the Pediculi be considered to form specific distinctions in them. It so happens, that not only are the differences, both between man and man, and Pediculus and Pediculus, very similar in degree, but they are also differences of the same kind. They are differences in colour and proportion of the very same, or, at all events, analogous parts in both. To attempt to draw any deductions from these differences in the Pediculi, would, therefore, be something like begging the whole question.

Nos. 3—6. PEDICULUS VESTIMENTI (body louse).—**3**. Specimens from Britain; **4**. Enlarged figure of ditto; **5**. Specimen on glass slide; **6**. Enlarged figure of anterior claw.

Pediculus vestimenti. 1½ to 1⅔ line in length.

Sucker of ditto.

This is distinct from the head-louse, but it is not easy to give

CASE XX. any very good specific characters. It is the larger and broader of the two. It is greyer and more uniform in colour, wants the spine at the top of the thumb, and has few or no projections on the inner side of the penultimate joint, characters which accord with its less scansorial mode of life, which requires less powerful appliances for seizing and tenaciously retaining hold of the hairs through which it passes. The concurrent opinion of those who are practically familiar with the animals and their habits also confirms the view that they are distinct species. We remember the remark of a young private soldier on his return, wounded, from the Crimea, who, in speaking of the sufferings of the troops before Sebastopol, dwelt upon the annoyance experienced from these parasites; and in reply to some suggestion as to the specific virtues of a small-toothed comb, which was understood to form part of a soldier's necessaries, answered, "Oh! we did not mind the head ones; it was the body ones,"—thus implying a clear and well recognised distinction between the two in power of annoyance. The remark of "a certain great personage" quoted by Leewenhoek as made to him when he exhibited to him this creature under the microscope, to the effect that his soldiers, who were infested with lice, found them more troublesome in rainy than in dry weather, also obviously applies to the body species.

They are exceedingly prolific. Leewenhoek ascertained the rate of multiplication by actual experiment. He disbelieved the vulgar saying that a louse might be a grandfather in twenty-four hours, and the mode in which he settled the question was this: He at first proposed to hire some poor child to wear a clean stocking for a week with two or three female lice in it, well tied or secured at the garter, in order to see how many young ones would be produced in that space of time; but he afterwards considered that he could make the experiment with much more certainty on his own person, at the expense only of enduring in one leg for a week or two what many people are obliged to suffer

CASE XX. in their whole bodies during their whole lives. It must be remembered that, if this looks like a calumnious aspersion upon those whom he calls "poor people," it was written two hundred years ago, and that Leewenhoek was a Dutchman. Let the galled jade in Leyden wince. In London here our withers are unwrung. He cannot mean to reflect on us. But to proceed. He accordingly put on one leg, instead of a white understocking that he usually wore, a fine black stocking, choosing that colour in order that the eggs and young lice might be more easily seen. Into this stocking he put two large female lice, and cutting another black stocking into long strips, he bound it over the first, we presume in two places, so as to keep his studs apart, as it were, in two paddocks, to prevent their escaping. After wearing this stocking six days he took it off, and found that one of the lice had laid fifty eggs and the other about forty, and in the body of one that he opened he found at least fifty more, besides undoubtedly having in its body many more that his powers of vision could not reach. Having tied them up again and worn the stocking ten days longer, he found in it at least twenty-five lice of three different sizes, and, not to make a long story of it, the conclusion he arrived at was that two female lice might in eight weeks be grandmothers, and see ten thousand of their own offspring—"and who can tell whether in the heat of summer these creatures may not breed in half the time."

This cumulative increase will sufficiently explain the vast numbers that we read of as occasionally swarming on those persons of whom the louse has taken posession, as it were. But it will not account for some of the cases where there has been no sufficient time allowed them to establish a colony by legitimate process of succession—as, for example, the following case mentioned by Denny:—"The sudden appearance of these creatures (says he) in vast numbers in places where they were not known before, and upon individuals previously free from such companions, is a circumstance not easy to account for. This, like

CASE XX. many other occurrences, has been viewed by the superstitious, and is still, as the prognostication of some impending evil, as sickness or misfortune to the individuals so visited. Without endeavouring to clear up the mystery, I can only bear testimony to the fact of their sudden occurrence, having known an instance when this species appeared in such quantities, that it was necessary to cleanse the bed linen twice a day for several days, at each of which visitations there appeared no visible decrease in their numbers, though at last they as suddenly disappeared. A late medical friend of mine says he held the opinion that the Pediculi migrate, and stated to me the following fact in confirmation of his belief:

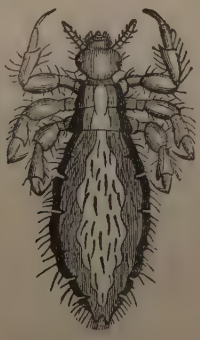
"His father, who was also a medical practitioner in the West Riding of Yorkshire for fifty years, had frequently in the course of his practice to enter the cottages of the poor in his neighbourhood (*i.e.*, colliers and cloth weavers). On one occasion, having a case which required his attendance near the bed for about half-an-hour, he found himself on his return home literally swarming with these gentry, both his coat and waistcoat, and beneath the collar of the former: to use his own words, 'you might have actually scooped them out with a teaspoon.' Now whether this was owing to his coming in contact with a legion on its march, or whether it might not be that a fresh subject has superior attractions for these puny persecutors, is a question for the decision of competent judges: of one thing, however, we are certain, that this locality was well stocked with this peculiar species of game." (Denny's Anoplura, p. 17). The latter suggestion is, no doubt, the true explanation of the case of the Yorkshire doctor and similar stories that we have heard. We do not think there is any warrant for the idea of migrations, and as for those cases that seem persistently to defy cleanliness and remedies, we believe that all they want is sifting. If properly sifted, there will always be found some dirty nurse or unclean garments that unwittingly supply fuel to the flame we wish to extinguish. Such a case fell

CASE XX. within our own limited experience, and we may quote it as a fair example of the kind of cases out of which the third kind of Pediculus (Pediculus tabescentium of authors), said to be peculiar to diseased persons, has been made up. Modern naturalists do not, we think, believe in it; and if Denny, in his work on the Anoplura, still gives it a place, he acknowledges that he has no actual knowledge of its occurrence. Our little experience of it was this: Dr. Jackson, of Edinburgh, some years ago consulted us regarding a case of the kind, where a patient, a young lad, was supposed to be infected with the Pediculus tabescentium. Repeated washings seemed to have no effect. A few hours after washing, the unfortunate victim was found again to be swarming as badly as before; and Dr. Jackson could speak to this fact from personal observation. We expressed our disbelief in the supposed disease, and recommended a more searching inquiry into collateral circumstances, and, above all, the securing specimens for examination. Dr. Jackson soon procured these; and neither of us will, we think, readily forget the examination of the specimens. Not being supplied with entomological apparatus, he had put them into an old pomatum pot, which happened to be at hand. With justifiable pride he announced that he had secured the desiderated specimens, and had three in this pomatum pot, which he had carefully enveloped in several folds of brown paper. On removing the paper, however, and opening the pot, to our dismay, instead of three specimens we found only one. The other two had escaped from the insufficiently secured vessel; but whether in Dr. Jackson's pocket or in our room we could not tell. Friendship has its limits; and we confess we were unfriendly enough to hope that the escape had taken place before the pomatum pot reached us. Fortunately their comrade remained to settle the question, that the supposed Pediculus tabescentium was only the common Pediculus vestimenti. Dr. Jackson had further ascertained the fact that, although the patient was frequently and carefully washed, he was always immediately thereafter re-indued in his old

CASE XX. dirty flannel jacket, whence the swarms were successively supplied which astonished beholders; and the further history of the case was, that so soon as the dirty flannels were burned, the mysterious disease disappeared, and the patient recovered. Such, we have no doubt, would be found to be the rationale of Lady Penruddock's case, and of all similar recorded cases of the disease of P. tabescentium, which have obtained credence from not having been examined at the time."

Before leaving this subject, it may be desirable to say a word or two as to the best mode of getting rid of these vermin. The treatment employed in the metropolitan hospitals and poorhouses, which has the recommendation both of ample experience and complete success, is the application of "white precipitate," which is the bicarbonate of mercury in the form of an ointment. It kills them at once.

Nos. 7—11. PEDICULUS CAPITIS (Head Louse).—**7.** Specimens from Britain and Russia; **8.** Enlarged figure of ditto; **9.** Specimen on glass slide; **10.** Anterior claw of ditto, much magnified; **11.** Illustrative vignette.



Pediculus capitis. ♀ to 1½ line in length.

Nos 12 15. PEDICULUS CAPITIS (Varieties from the Esquimaux).—**12.** Specimens, and Enlarged figure of ditto; **13.** Specimen on glass slide; **14.** Anterior claw, much magnified; **15.** Illustrative vignette.

CASE XX. Nos 16—20. PEDICULUS CAPITIS (Variety from Californian digger, Indian).—**16.** Specimens; **17.** Enlarged figure of ditto; **18.** Specimen on glass slide; **19.** Anterior claw, much magnified; **20.** Illustrative vignette.

Nos. 21—25. PEDICULUS CAPITIS (Variety from Indian of the Andes of Quito).—**21.** Specimen; **22.** Enlarged figure of ditto; **23.** Specimen on glass slide; **24.** Anterior claw much enlarged; **25.** Illustrative vignette.

Nos. 26—30. PEDICULUS CAPITIS (Variety from Tierra del Fuego).—**26.** Specimens; **27.** Enlarged figure of ditto; **28.** Specimen on glass slide; **29.** Anterior claw much enlarged; **30.** Illustrative vignette.

Nos. 31—35. PEDICULUS CAPITIS (Variety from West African Negro).—**31.** Specimens; **32.** Enlarged figure of ditto; **33.** Specimen on glass slide; **34.** Anterior claw much enlarged; **35.** Illustrative vignette.

Nos. 36—40. PEDICULUS CAPITIS (Variety from Mozambique Africander).—**36.** Specimens; **37.** Enlarged figure of ditto; **38.** Specimen on glass slide; **39.** Anterior claw, much enlarged; **40.** Illustrative vignette.

Nos. 41—45. PEDICULUS CAPITIS (Variety from Hindoos).—**41.** Specimens; **42.** Enlarged figure of ditto; **43.** Specimen on glass slide; **44.** Anterior claw, much enlarged; **45.** Illustrative vignette.

Nos. 46—50. PEDICULUS CAPITIS (Variety from Australia).—**46.** Specimens; **47.** Enlarged figure of ditto; **48.** Specimen on glass slide; **49.** Anterior claw, much magnified; **50.** Illustrative vignette.

Nos. 51—54. **51.** Causes of vermin, illustrative vignette; dirt and overcrowding; **52.** ditto; misery; **53.** ditto; disease; **54.** remedies, cleanliness, &c.

CASE XXI.

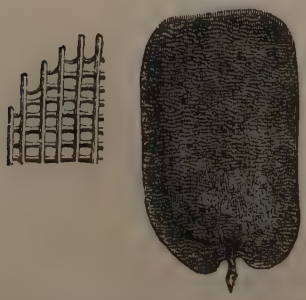
Order THYSANURA, *Latr.* (Spring tails).

This order of insects is certainly not in its natural position here. We do not pretend that it is; but unless we were to abandon the great convenience of bringing all the Apterous insects into one group, we do not see where else we could put them. Their natural position is between the Crustacea and the Neuroptera (the lace-winged flies). Some entomologists place them among the Neuroptera, some among the Orthoptera, but this seems to us a stretch of arbitrary power, even worse than putting them here. Perhaps we should have begun with them, but they would have lain like an isolated lump as much at the beginning as here, leading to nothing, and would have interfered with the natural transition from the Isopodous crustaceans to the Myriapods; and Sir John Lubbock's interesting discovery of the genus Pauropus, which seems at once to connect the Myriapods with the Thysanura, and both with the Crustaceans, seems to warrant us at least in bringing this group into the Aptera. The reader, therefore, will regard their interpolation here as one of the digressions that we have more than once been forced to adopt as a choice of difficulties.

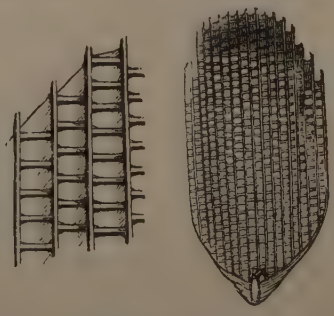
We do not say that it would not be more philosophical to do away with the Aptera as a distinct division altogether, and to have carried the Pediculi to the Hemiptera, the Thysanura to the Neuroptera or Orthoptera, and treated the remaining groups not as Aptera, but simply as Arachnids and Myriapods; but the course we have taken has its conveniences, and its adoption does not in any way interfere with the proper understanding of the different groups, or put any obstacles in the way of studying them.

Until 1873, this order was always regarded as a single group, sufficiently homogeneous. Sir John Lubbock, however, in that year published an able and exhaustive monograph of them, and gave it as the result of his researches that there was so much difference between two parts of it that they could not be included

CASE XXI. in the same order, and consequently broke it up and made two orders of it—one, the Spring tails, which he called Collembola, and the other the Lepismidæ, for which he retained the name Thysanura. No one can dispute that there is a marked distinction between the two—the one with its jumping apparatus, and the other with its projecting terminal, jointed bristles, besides other distinguishing characters—and effect must be given to these differences in some shape; but whether it is sufficient to warrant the establishment of two orders seems doubtful. This is not the place to go into a discussion as to the value of the differences and resemblances, but we may point to one that, although trifling in itself, seems to us very suggestive. It is the identity in type of the peculiar scales with which they are clothed, and which are common to, although not universal in, both sections, and are met with in no other order of insects. These scales have another and an economic interest for us: they have for long been employed as tests for the quality of object-glasses of the microscope, from the facility with which they display both the spherical and chromatic aberrations. The woodcuts show the scale of Tomocerus (one of



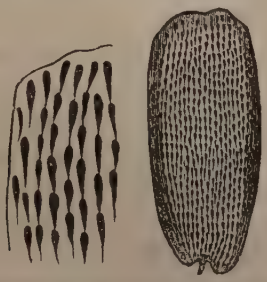
Scale of Tomocerus longicornis, much magnified, and portion of it still more enlarged.



Scale of Machilis, much magnified, and portion of it still more enlarged.

the Collembola) and that of Machilis (one of the Lepismidæ—Lubbock's Thysanura), and it will be seen that the type is the same in both. We also show the more common form of the scale

CASE XXI. of species of Collembola, being that of a scale of Lepidocyrtus curvicollis, which, no doubt, deviates from the others, but still



Scale of Lepidocyrtus curvicollis, much magnified, and portion of it still more enlarged.

bears the same cachet. We therefore propose to retain the name Thysanura for the whole order, and to take Sir John's name Collembola for the first section, and leave the other under its old name of Lepismidæ.

Tribe COLLEMBOLA.

Horticulturists, at least those who possess "frames," still more those who have cucumber-frames or hot-beds, are pretty familiar with the insects of this family. If we place a cloth over the glass, we shall probably find next morning, on removing it, that the place where it lay is swarming with a quantity of minute soft delicate insects, some of which will take to their heels and endeavour to escape by running, and others will spring upwards with considerable force, taking bounds which, were we able to take them proportionately high, would carry us over our highest steeples. These surprising leaps are not made like those of the flea and most other jumping insects, by means of powerful muscles placed in very thick thighs, but by means of a sub-abdominal forked organ, which acts as a spring very much in the same way that the toy familiar to our boyhood called a jumping-frog does. These are Collembola. But it is inside the frames that we see them in greatest numbers; they often swarm there as thick as powder,

CASE XXI.

in the chinks and corners, and we find too that they are not harmless tenants. Our young gherkins will be found shrivelling, and on examination, it will be seen that they have been stripped of great portions of their skin, that have been browsed or rasped away by these little creatures. Nor are their ravages confined to frames, although the greater heat there, seems to suit their delicate semi-transparent bodies. But in the open borders they carry on the same work on succulent roots and plants, especially where anything has happened to diminish the vitality of the plant. On carrots, for instance, that are suffering from rust, they will be found browsing on the sound parts.

Mr. Curtis (farm insects) mentions that in Nova Scotia, the crops of turnips and cabbages are principally destroyed whilst in the seed-leaf by some species of this tribe, the size of a pin's head, and nearly globular. It hops with great agility by means of its forked spring, and may be found on every square inch of all old cultivated ground, but it is not plentiful on new land. He adds, probably from Nova Scotian information, that, "as these 'ground fleas,' will not remain on damp ground, they may be expelled by sprinkling salt over the land after the seed is sown and well rolled down, or a thin layer of sea-weed spread over the drills, is a perfect security against them." In some respects, this information must be erroneous, for it is especially in dampish places that the spring tails luxuriate. Drought kills them. Some few species (Podura aquatica, Smynthurus aquaticus, and Isotoma aquatilis) frequent the surface of standing water. Some species of Smynthurus live on the leaves of plants; Seira domestica frequents houses; Lepidocyrtus curvicollis, is found in cellars; and Lipura maritima occurs on the sea-shore between tide marks; but the species of this group are chiefly to be found in loose earth among dead leaves, under bark, and in similar situations, and that as a rule, their food is vegetable matter, and most frequently decaying vegetable matter.

We do not however know much of the habits of these creatures.

CASE XXI. We do not even know what is the special purpose for which their most striking peculiarity, their spring tails, is given.

As Sir John Lubbock says, the possession of a powerful saltatory apparatus appears to be a fantastic provision, for a species which lives in the chinks and crannies of bark, in the interstices of fungi, or buried among decaying leaves, in other words, in places where the saltatory power can only be occasionally exercised, and the anomaly is by no means diminished by the circumstance that, as a matter of fact the jumping and non-jumping species are continually found together under the same old board, or in the same decaying heap of leaves. Still we know that it must serve a purpose, and one useful to the creature endowed with it.

The Collembola are divided by Lubbock into six families, for the scientific characters of which we must refer the reader to his work. It is only exceptionally that we give detailed characters in this work. As far as they go we endeavour to supply their place by illustrations, and we shall merely note one or two salient points which may serve to guide the reader to the family to which his species belongs. And here let us begin at the beginning. Supposing we have in our hands a species of Thysanura, how are we to tell whether it is one of the Collembola or one of the Lepismidæ? If it has either two- or three-jointed bristles at the tail, then it belongs to the latter—if not, then to the former.

In the next place it may have a jumping apparatus, or it may not. It is not, however, to be taken for granted that it is not a jumper, because it has not jumped and no jumping apparatus is visible. This is packed away under the body from the tail forwards, and will be seen when searched for. Let us suppose then that our species has got the jumping apparatus. It then belongs to the first section of Collembola. Further, it may be of an elongate cylindrical shape, or it may have a globular body, seemingly composed of a head and a bag. If the latter, it must either be a Smynthurus or a Papirius. In both the antennæ are four-jointed, but in the former the terminal joint is long, in the latter short.

CASE XXI.

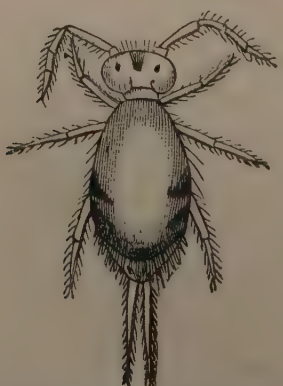
But suppose, on the other hand, that the species is elongate and not globular, then it must either belong to the Degeeriadæ or to the Poduridæ. If to the former, it has its jumping apparatus attached to the fifth abdominal segment; if to the latter, to the fourth. Supposing it to belong to the former, it is an Orchesella if its antennæ have six joints, if only four or five it may belong to one or other of eight genera which we shall mention below.

If the jumping apparatus is attached to the fourth abdominal segment (Poduridæ) it may have either one or two claws to its feet. If two claws, it is an Achorutes—if one, a Podura.

But it may have nothing of all this and be without a jumping apparatus at all. Well, in that case it will be found either to have mandibles or not. If it has them, it is a Lipura. If it has none, but a suctorial mouth instead, then it must be Anoura.

Family SMYNTHURIDÆ.

No. 1. SMYNTHURUS FUSCUS (*Linn.*).—1. Magnified sketch of ditto.*



Smynthurus fuscus. Copied from Templeton's figure in Tr. Ent. Soc. I. 0.125th of an inch in length.

Smynthurus viridis. Copied from Templeton's figure. 1-12th of an inch in length.

* Where not otherwise stated, all the sketches of Thysanura are taken from Mr. Hollick's figures in Sir John Lubbock's monograph.

CASE XXI. This is the largest of the Smynthuri, about 1-10th of an inch in length. It is common about London, and no doubt elsewhere, on pieces of wood and bark in damp situations. It feeds principally on the spores and first shoots of fungi, and Sir J. Lubbock mentions that many specimens are infested by a small mite which adheres to its under side in considerable numbers.

SMYNTHURUS VIRIDIS (*Linn.*).

Green eyes on a black patch; common.

Lubbock describes eight species of Smynthuri as found in England, and notices several others from the Continent and foreign parts. In his "Farm Insects," Curtis describes a species which he calls Smynthurus Solani as possibly or probably injurious to the potato crop by browsing on the parenchyma of its green leaves, on which it may be found in quantity running and skipping about their under side and often falling down on its back. He says it is not bigger than a small grain of sand, and either entirely of a deep ochreous colour with black eyes, or as black as soot with ochreous horns. He gives a figure of it, but neither his figure nor his description is sufficiently detailed to allow of its accurate determination, and it is not impossible that he may have confounded two species. If so, his species would most probably be S. luteus and S. niger, viz.:—

SMYNTHURUS LUTEUS (*Lubb.*).

Yellow; eyes on a black patch; apical part of antennæ violet.

Sir John Lubbock gives the following account of the courtship of this species, the only one whose amours have been observed:—"It is very amusing to see these little creatures coquetting together. The male, which is much smaller than the female, runs round her, and they butt one another standing face to face, and moving backwards and forwards like two playful lambs. Then the female pretends to run away and the male runs after her with

CASE XXI. a queer appearance of anger; gets in front and stands facing her again; then she turns coyly round, but he quicker and more active, scuttles round too, and seems to whip her with his antennæ. Then for a bit they stand face to face, play with their antennæ, and seem to be all in all to one another."

S. NIGER (*Lubb.*).

An ugly little species, bluish black; feet, terminal segment of spring, and a spot at inner corner of eye-patch, pale. Said by Lubbock to be not common.

No. 2. PAPIRIUS ORNATUS (*Nicolet*).—**2.** Magnified sketch of ditto.

Found in the latter part of November, December, and January, among leaves and under logs of wood, with Smynthurus fuscus and Papirius fuscus. It is of livelier colours than either of these (black, green, and various shades of brown), and of more active habits, running freely and jumping more lightly and gracefully.

No. 3. PAPIRIUS FUSCUS (*Luc.*).—**3.** Magnified sketch of ditto.

Papirius fuscus. 00.5 of an inch in length.

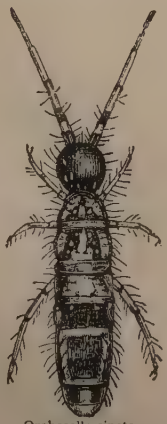
Brown. Common.

Family DEGEERIADÆ.

Nos. 4—6. ORCHESELLA CINCTA (*Linn.*).—**4.** Specimens of ditto; **5.** Enlarged sketch of ditto; **6.** Enlarged sketch of another variety of ditto.

A very common, pretty, and variable species found under fallen

CASE XXI. boughs of trees, in moss, among decaying leaves and similar situations. There are only two species of this genus found in Britain, the present and another named O. villosa. The latter is yellow, and has the entire body mottled with black, whereas O. cincta, although very variable and often yellow mottled with black, has always the third segment of the abdomen black. The whole insect is sometimes almost entirely black. The body in this genus is without scales.



Orchesella cincta. 0.25 of an inch in length.

Nos. 7, 8. TOMOCERUS LONGICORNIS (*Müller*).—**7.** Magnified sketch of ditto; **8.** Magnified sketch of scale of ditto.

The antennæ in the genus Tomocerus are long (in this species very long and rolled up at the apex like a piece of tape) four-jointed, the two terminal segments being multiarticulate or ringed. The body is clothed with scales and the eyes are seven in each group.

The colour of T. longicornis is leaden unless where the scales are removed, when it is yellow. The antennæ are longer than the body. It is a large species, being one-fifth of an inch in length, found in England and on the Continent, under logs, &c., throughout the year.

Tomocerus plumbeus. 1-5th of an inch in length.

No. 9. TOMOCERUS PLUMBEUS (*Linn.*).—**9.** Magnified sketch of ditto.

Similar to the last species, but the antennæ are shorter than the body; the body where the scales are removed is leaden-coloured. Found with the preceding; common all through the winter, even during sharp frosts.

CASE XXI. Nos. 10, 11. SEIRA BUSKII (*Lubb.*).—**10.** Magnified sketch of ditto; **11.** Magnified sketch of scale of ditto.

The antennæ of Seira are four-jointed, the body clothed with scales. The terminal segment of the antennæ is simple; it has eyes, and the head is not concealed under the thorax.

The species S. Buskii is dark violet with metallic reflections. Lubbock found it only in green-houses and hot-houses, whence he, with apparent justice, infers that it is probably an exotic species introduced.

No. 12. TEMPLETONIA CRYSTALLINA (*Lubb.*).—**12.** Magnified sketch of ditto.

Templetonia is an interesting genus combining a number of characters belonging to different genera. Its scale is peculiar to itself, and its antennæ are five-jointed instead of four-jointed like its allies. The first joint, however, is small, and may be overlooked if not sought for. Its eye consists of one lens in each eye-patch. The species when alive is silvery white, but when it has been a few days in spirits it becomes pale with innumerable reddish brown streaks and spots. It has figured in no less than six different genera, a sufficient indication of the difficulty of placing it in any of the old ones and of the necessity of a new genus for it. Said to be common in Kent.

No. 13. BECKIA ARGENTEA (*Lubb.*).—**13.** Magnified figure of ditto.

Beckia may be said to be a Seira without eyes. The species argentea is silvery with metallic reflexions.

Nos. 14, 15. LEPIDOCYRTUS CURVICOLLIS (*Bourlet*).—**14.** Magnified sketch of ditto; **15.** Magnified sketch of scale of ditto.

Lepidocyrtus curvicollis. 2½ millimètres in length.

Lepidocyrtus is a Seira with its head overshadowed by the

CASE XXI. projecting front of the thorax. When full grown and unrubbed it reflects the most gorgeous metallic tints. As remarked by Sir John Lubbock, its general appearance is most singular; the depressed position of the head, and the gait gives it a most ludicrous resemblance to a hippopotamus, and at the same time the body does not look as if it belonged to the head and legs, but rather as if it were some foreign object supported on the animal's back. Mr. Beck the microscopist speaks of the scales of this species, or of a variety of it, as being a superior test for object glasses. This species seems uncommon, but another L. lignorum is very common. There are a number of British species of this genus.

No. 16. DEGEERIA ANNULATA (*Fab.*).—**16.** Magnified sketch of ditto.

Degeeria has no scales, and the segments of the abdomen are unequal. Its antennæ have four joints, and a minute basal ring. There are eight eyes in each eye-patch. We have followed Sir J. Lubbock's arrangement in placing Degeeria here, but we cannot help thinking that the natural place, both of Degeeria and Isotoma, is next Orchesella. They are smaller, but similar in make to it, and, like it, have no scales, and their general appearance and system of coloration are disposed very much on the same pattern.

Degeeria annulata, 1-10th of an inch in length.

This species is pale greenish yellow or stone colour, with brown transverse markings. Under logs in Kent throughout the year.

No. 17. ISOTOMA VIATICA (*Linn.*).—**17.** Magnified sketch of insect.

This genus is very like the preceding and Orchesella, differing from Degeeria in having the segments of the abdomen sub-equal. The present species is bluish black. It is not common, and January to April is said to be its period of appearance.

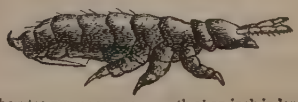
CASE XXI. No. 18. ISOTOMA GRISEA (*Lubb.*).—**18.** Magnified sketch of ditto.

Uniform grey; common in winter and spring.

Family PODURIDÆ.

No. 19. ACHORUTES PURPURASCENS (*Lubb.*).—**19.** Magnified sketch of ditto.

One of the Poduridæ with two claws, of a brownish-purple colour.



Achorutes purpurascens. 1-12th of an inch in length

"On a hot bed, and under branches of trees. Throughout the year."—(*Lubbock*).

No. 20. PODURA AQUATICA (*Linn.*).—**20.** Magnified sketch of ditto.

One of the single-clawed Poduridæ; opaque blackish-blue. Common on the surface of standing water throughout the north of Europe to Switzerland. Also found in Greenland.

Podura aquatica. 0.08 of an inch in length.

Lipura fimetaria. 1-10th of an inch in length.

No. 21. LIPURA FIMETARIA (*Linn.*).—**21.** Magnified sketch of ditto.

We have now left the jumping Collembola. The following species only run. This species is very common, and may be found in damp earth throughout the year, often engaged in

CASE XXI. browsing upon carrots, potatoes, or other roots. It is white, and of a velvety texture, as are several other species.

The Lipuræ as a genus are interesting from an evolution point of view. We have, in speaking of marine mites, alluded to the fact that certain insects, and more particularly certain beetles, passed their lives under the very exceptional condition of spending half their time under the sea. They live between high and low water-mark, in the chinks of rocks, under beds of sea-weed, and similar places of shelter; and this is a manner of life not peculiar to one country alone. Wherever there are suitable sea-coasts, there we shall doubtless find some of these beetles; at any rate, we know that they occur on the coasts of Europe, Madeira, North America, Chili, New Caledonia, and Australia, different species in each, but all belonging to the same two contiguous families, the Trechidæ and Bembidiidæ. Now it is worthy of note that it is the same family that supply some (not all) of the eyeless species that live under another peculiar and abnormal condition, viz., in the dark limestone caverns of Carniola, Kentucky, &c. It is as if they had a special facility of adaptation given them for accommodating themselves to any condition of life. If it were not so, why have thousands of other families of insects not done the same? We cannot suppose that no Carabidæ but the Trechidæ, although there are four or five hundred genera, were subjected to the same trial, and that they alone were subjected, not only to the trial by darkness, but also to the trial by sea. If we did, the present genus would help to confute the idea. It also contains a species that lives under the sea, and another that lives in dark caverns. One family thus furnishing a double adaptation in both instances, implies that there is something special in them favourable to their accommodating themselves to unwonted conditions.

LIPURA MARITIMA (*Guer.*).

Dark lead coloured, and of a velvety texture that throws off

CASE XXI. water. Found under young sea weed and between layers of shale between tide marks in the Firth of Forth, and along the coast both to the north and south, also at Kinsale in Ireland, and on the French coast, occurring no doubt wherever there is a suitable habitat.

LIPURA STILLICIDII (*Sch.*).

A white species, very common in the Adelsberg caves. Either it or a closely allied species also lives in the Mitchelstown cave near Cahir, in Ireland. It is eyeless; for although there are two rows of seven prominences in the place behind the antennæ, and before that where the eyes should be, which have been called eyes, we think that their very unusual profusion in a medium where no other insect has any eyes at all, or any use for them, is not favourable to the idea of their being eyes. They also occur in other species where eyes are present.

No. 22. ANOURA MUSCORUM (*Temp.*).—**22.** Magnified sketch of ditto.

Anoura muscorum. 0.07 of an inch in length.

This is another of the non-saltatorial genera, and it is the only one of the Collembola that has no mandibles. It is suctorial. The species is of a dark purple colour, and is found under wood and bark. It is common.

No. 23. ANOURA GRANARIA (*Nic.*).—**23.** Magnified sketch of ditto.

This is of an alabaster white, and has occurred under detritus in France and England, but it has not been often met with. These are the only species of Anoura that have been found in Britain.

CASE XXI.

Tribe LEPISMIDÆ.

The Lepismidæ are composed of two well-marked divisions, the one without scales and also without eyes; the other with both scales and eyes, and the scales of the same type as those of the Collembola. They have all got mandibles; farther than that, we do not know much of their habits. Unlike the Collembola they prefer dry and warm or even hot localities.

Sect. I.—Without Scales.

Sir John Lubbock takes this division first, and we have followed him, although we should have preferred to bring them last, as we think the genera Lepisma and Machilis are more closely united to the Collembola than it is. Their scales, aspect, and coloration, which often reveal affinities, which the actual structure has not prepared us for, all, we think, indicate that the nearer relationship is with the second section. But it is for everyone's convenience to follow a recognised authority, even when we differ from him (unless the difference be extreme), and therefore we proceed first with the section which contains the two latter genera. This is represented in Britain by only a single species.

No. 24. Campodea staphylinus (*Westw.*).—**24.** Magnified sketch of ditto.

An elongated parallel soft white insect, which is common in loose damp earth. The chief interest, both in this species and the next, lies in its structure and affinities.

No. 25. Japyx solifugus (*Halliday*).—**25.** Magnified sketch of ditto.

This is a species of another genus (Japyx), which is as well entitled to a section for itself as Campodea. It has a pair of forceps at the tail fashioned like those of the earwig. It occurs in the Mediterranean district, and as far north as Paris, but has not been found further north, nor in Britain.

CASE XXI. Nos. 26, 27.

Lepisma saccharina. 1-3rd of an inch in length.

Sec. II.—With Scales.

Lepisma saccharina (*Linn.*).—**26.** Magnified sketch of ditto; **27.** Magnified sketch of scale of ditto.

An easy distinction between this genus and Machilis (the only British members of this section), is that Lepisma is not saltatorial, Machilis is. This species is silvery white, with a yellowish tinge about the antennæ and legs. Common not only in Britain, but over the greater part of the Continent. There is no other species in Britain.

Nos. 28, 29

Machilis maritima (*Leach*).—**28.** Magnified sketch of ditto; **29.** Magnified sketch of scale.

Brown, mottled, with bronze reflections. Common on the rocky shores of England, Ireland, and France.

Machilis maritima. 0.5 of an inch in length.

This and Machilis polypoda (a brown species, which is found in woods and dry places) are the only two that have been found in Britain.

LIST OF ILLUSTRATIONS.

	PAGE
Oniscus asellus	8
— antenna of	8
Porcellio scaber	10
— antenna of	10
Armadillo vulgaris	10
— rolled up	10
— antenna of	10
Glomeris limbata	15
Sphæropæus glabratus	16
— castaneus, antenna of	16
Julus in young stage with only six legs	16
— older, with 14 legs	16
— pulchellus, full-grown	17
— terrestris	18
— antenna of	18
— Londinensis	19
— nitens	19
Spirostreptus annulatipes	20
Polydesmus complanatus, young and full grown	21
Brachycybe rosea	21
Polydesmus dorsalis	21
Geophilus longicornis	22
Scolopendra morsitans	24
— variegata	26
Cryptops hortensis	28
Lithobius forficatus	28
— head and antenna of	28
Cermatia smithii	30
Pauropus huxleyi	32
Chelifer musæorum	35
— cancroides	35
Obisium carcinoides	35

	PAGE
Buthus afer.	37
Væjovis, sp.	38
Phrynus palmatus	39
Telyphonus proscorpio	40
Galeodes araneoides	41
Mygale avicularia	52
Atypus sulzeri	55
— nest of	55
Cteniza ionica, trap-door of	56
— fodiens	57
— nest of	57
Nemesia cæmentaria, trap-door of	58
— eleanora, trap-door of	58
— — nest of	59
— meridionalis —	59
— cæmentaria, figure of	60
— Eleanora —	60
Latrodectes malmignatus	65
Lycosa tarantula	68
Dysdera crocata	70
Drassus sericeus	71
Eresus cinnabarinus	71
Argyroneta aquatica	73
Water-spiders under water	74
Ciniflo ferox	75
Ciniflonidæ, web of	76
Calamistrum of Ciniflo	76
Agelena labyrinthica	77
Tegenaria guyonii	78
Pholcus phalangioides	79
Theridion tepidariorum	80
— nest of	80
— lineatum, cocoon of	81
— pallens, cocoon of	81

PAGE

Walckenæria pratensis . . . 82
Epeira diademata, web of . . 83
— threads of web of . . 84
— diademata . . . 85
Xysticus cristatus 87
— audax 87
Thomisus abbreviatus . . . 88
Dolomedes fimbriatus . . 89
Epiblemum scenicum . . . 92
Trombidium fuliginosum, palpi of 95
— typical palpus of . . 95
Tetranychus prunicolor, claw of 96
Trombidium holosericeum, claw of 96
Tetranychus telarius, tarsus of . 97
— mouth, palpi, and mandible of 97
— young 97
— male 97
— female 98
— lintearius 104
— tiliarum 108
— socius. 108
— eriostemi . . . 109
— autumnalis. . . . 109
Raphignathus ruberrimus . . 115
— ruber 115
Megamerus celer . . . 115
Leptus americanus . . . 116
— irritans 116
Bryobia speciosa 118
Petrobia lapidum, young . . 118
— full-grown 118
Tydeus mutabilis . . . 120
Eupodes hiemalis 120
— celer, young . . . 121
— — mature . . . 121
Penthaleus hæmatopus . . 121
Scyphius diversicolor . . . 122
Linopodes longipes . . . 123
Penthalodes ovalis . . . 123
Stigmæus cruentus . . . 124
Caligonus piger 124
Rhyncholophus cinereus . . 125

PAGE

Rhyncholophus phalangioides . 125
— major 126
Smaridia papillosa, rostrum of . 126
— papillosa 127
Pachygnathus velatus . . 128
Trombidium parasiticum . . 129
— holosericeum, young . 130
— — mature . . . 130
— — under side. . . 130
— — hairs on upper side . 131
— — hairs on sides . . 131
— trigonum 133
— — hairs on back of . 133
— curtipes 134
— — hairs on back . . 134
— — hairs on sides . . 134
— fasciculatum . . . 135
— tinctorium 135
— bulbipes 136
— gryllarium, young . . 136
— sericeum 138
— aurantiacum . . . 139
Calyptostoma Hardyi . . 140
— — under side . . . 140
— — side view . . . 140
— — leg 140
Erythræus ruricola . . . 141
— cornigera 141
Molgus longicornis, mouth of . 143
Eupalus vitellinus 144
Scirus vulgaris 144
— insectorum, young . . 145
— — (leptus phalangii) . 145
— hexophthalmus . . . 146
— obisium 146
Hydrachna, palpus of . . . 147
Atax bonzi, claw of . . . 147
Limnochares aquaticus . . . 148
Thyas venusta 149
Smaris impressa 149
Alycus roseus 150
Eylais extendens, young . . 150
— — mature . . . 150

PAGE

Hydrachna, nymphs of, adhering to hinder part of nepa cinerea 151
— geographica . . . 152
Limnesia fulgida 152
Diplodontus scapularis, young . 153
— — mature . . . 153
Hydrochoreutes globulus . . 154
— — nymph . . . 154
— — perfect insect, under side 154
Hydrachna globator, male . . 155
— — female . . . 155
Atax histrionicus, male . . 156
— — female . . . 156
Gamasus tetragonoides, claw of . 157
Dermannyssus avium, claw of . 157
— auris, claw of . . . 157
Gamasus coleoptratorum . . 158
— marginatus . . . 159
Lælaps hilaris 159
Gamasus crassipes . . . 161
— tetragonoides . . . 161
— podager 161
Uropoda vegetans . . . 162
Zercon dimidiatus . . . 164
Sejus vidius 165
— maritimus . . . 166
— marinus 167
Halarachne halichæri, young . 168
— — mature . . . 168
Dermanyssus hitzschii . . 169
— avium 170
— — under side . . 170
— pipistrellæ 172
Liponyssus setosus . . . 173
Macronyssus longimanus . . 173
Lepronyssus rubiginosus . . 174
— lobatus 174
Pimelonyssus biscutellus . . 174
Vampire, hair of 175
Diplostaspis dasycnemi, hair of . 175
Periglischrus rhinolophinus . . 177
— caligus 177

PAGE

Tinoglischrus punctolyra . . 178
— — under side . . 178
— audouinii 178
Diplostaspis vespertilionis . . 179
— arcuata 179
Leiostaspis zeleborii . . . 180
Argas reflexus, tarsus of . . 180
— pipistrellæ, young . . 180
— — leg of 180
— reflexus 181
— miniatus 182
— moubata . . . 182
— (ornithodoros) coriaceus . 183
— — talaje 183
Ixodes, rostrum of . . . 184
— claw of 184
— erinaceus, male . . . 190
— — female . . . 190
— fodiens 191
— marginatus, male . . 192
— — female . . . 192
— transversalis . . . 195
Sarconyssus nodulipes . . . 196
Hyalomma hispanicum, male . 197
— — female . . . 197
Hæmalastor longirostris . . 198
— gracilipes 199
Dermacentor pardalinus . . 199
Hæmaphysalis rosea . . . 200
Rhipicephalus senegalensis . 200
Adenopleura compressum . . 200
Xiphiastor rostratus . . . 201
Amblyomma rotundatum . . 201
Ophiodes flavomaculatus . . 204
Halacarus ctenopus . . . 208
— falcatus 209
— — claw of . . . 209
— — mandibles of . . 209
— sculptus 209
— — under side . . 209
— — side view . . . 209
— — mandible and palpus of . . . 209

PAGE

Halacarus rhodostigma . . . 210
— notops 211
Damæus auritus, head of . . 212
— — leg of . . . 215
— — claw of . . . 215
— geniculatus, young . . 215
— — mature . . . 215
Leiosoma ovata, young stage . 217
Notaspis bipilis, mature . . 217
Oribata punctata, young . . 218
— globula, mature . . . 218
— — mandible of . . 218
Pelops acromios, young . . 219
— — mature 219
— — — leg of . . . 219
Nothrus spiniger, young . . 220
— — claw of . . . 220
— horridus, mature . . 220
— — covered with its cloak of dirt . . . 220
Hermannia crassipes, young . 221
— — mature . . . 221
Eremæus tibialis, young . . 222
— — mature . . . 222
Hoplophora contractilis . . 223
— — shut up . . . 223
— — leg of . . . 223
— — larva of . . . 224
— arctata 225
Hypoderas brevis 229
— — under side . . 229
— lineatus, under side . . 230
— columbæ, under side . 230
— — on vein of pigeon. . 230
Hypopus muscarum . . . 234
— — lip of 234
— filicum 235
— arvicola 236
Rhizoglyphus echinopus, young . 238
— — with young developing inside . . . 238
Hypopus, inside of ditto . . 239
— removed from ditto . . 239

PAGE

Hypopus, with Tyroglyphus mycophagus emerging from it 242
— alicola 250
Trichodactylus osmiæ, leg of . 251
— osmiæ 252
— — 252
— xylocopæ 253
Homopus elephantis . . . 253
— — mouth of . . . 253
Rhizoglyphus, tarsus of . . 256
Tyroglyphus, tarsus of . . . 256
Rhizoglyphus echinopus, young . 257
— phylloxeræ 258
— rostroserratus . . . 261
— — side view . . . 261
— — mouth of . . . 262
— mycophagus . . . 263
Tyroglyphus siro . . . 268
— — more magnified . . 268
— longior 271
Acarus horridus 273
— weekesii 273
Tyroglyphus siculus . . . 274
— malus, under side . . 275
— — side view . . . 275
Glyciphagus spinipes, mouth of . 276
— — hair of . . . 276
— — claw of . . . 276
— cursor 278
— hippopodos . . . 279
— buski 280
— spinipes 281
— plumiger . . . 283
— palmifer, male . . . 284
— — female . . . 284
Cheyletus eruditus, male . . 286
— mericourti, female . . 289
Heteropus ventricosus . . . 290
— — impregnated female . 290
— — leg of ditto . . . 290
Sarcoptes scabiei, anterior leg and sucker . . 291
— — mouth 291

PAGE

Sarcoptes scabiei, male, under side 292
— — female, ditto . . 292
— — two of posterior legs of male . . 293
— — two of posterior legs of female . . . 293
— — burrow of . . 294
Sarcoptes dromedarii . . . 305
— mutans, male . . . 305
— — female . . . 305
— — side view . . . 306
Psoroptes equi, mandibles . . 308
— — anterior leg and sucker 308
— — figure of . . . 309
— — two of posterior legs of male . . 309
— — two of posterior legs of female . . . 309
Symbiotes bovis . . . 313
— — anterior leg and sucker 313
Sarcopterus nidulans . . . 314
Myobia musculi, young . . 316
— — female . . . 316
— — mouth and anterior legs more highly magnified . . 316
— — posterior leg and tarsus 316
English bat, magnified hair of . 318
Otonyssus sticholasius, magnified hair of . . . 318
— — magnified bristle of . 319
— — tarsus of, copied from Kolenati 319
— — — copied from Maddox . . . 319
— — palpus, copied from Kolenati . . . 320
— — mouth of do. . . 321
— — — more magnified . 321
— — copied from Kolenati 323
— — — — Maddox . 323
Peplonyssus seminulum . . 324
— pagurus 324

PAGE

Listrophorus Leuckarti, mouth of 325
— — leg of 325
— gibbus 325
— Leuckarti 325
Myocoptes musculinus, male . . 326
— — female . . . 326
— — seen in front . . 326
— — mouth of . . . 326
Dermaleichus bifidus, male . 328
— — female . . . 328
— chelopus, male . . 329
— — female . . . 329
Demodex folliculorum . . . 330
— — in bulb and follicles of human hair . . . 330
Lime tree leaf with nail galls . 332
Section of gall on do. . . 332
American vine leaf with trumpet gall formed by a Cecidomyia 335
Section of gall on do. . . 335
Sallow leaves with galls produced by Phytoptus salicis . . 337
Section of gall on do. . . . 337
Phytoptus salicis . . . 339
— tiliæ 339
— ribis 339
— pyri 340
Gamasus, supposed by Scheuten to be perfect insect of ditto . 340
Hypopus, supposed by Scheuten to be larva of ditto. . . 341
Flexipalpus tiliæ 342
Tetranychus tiliæ, supposed by Scheuten to be perfect Flexipalpus tiliæ . . . 342
Phytoptus, after Löw . . . 346
— head of — . . . 346
— leg of — . . . 347
— tail of — . . . 348
— pyri, claw of . . . 348
— tiliæ, claw of . . . 348
Currant buds attacked by Phytoptus ribis 355

PAGE

Bract of Tilia parvifolia attacked by Phytoptus tiliarius . . 356
Volvulifex aceris on sycamore leaf 357
— section of . . . 357
Cephaloneon myriadeum . . 358
Pear leaf with galls of Typhlodromus pyri . . . 359
Section of gall of ditto . . . 359
Ceratoneon on leaves of sloe . 360
Section of ditto 360
Volvulifex pruni on plum twig . 361
— on plum leaf . . . 361
Menopon pallidum . . . 377
— posterior leg . . . 377
Trinoton luridum . . . 378
— anterior leg . . . 378
Docophorus semisignatus, head of 378
— icterodes 379
Nirmus claviformis . . . 379
Goniocotes hologaster . . . 380
Goniodes falcicornis . . . 380
— dissimilis 381
— — anterior leg of . 381
— tetraonis 381
Lipeurus, antenna of male . . 381
— variabilis 382
— squalidus . . . 382
Ornithobius cygni . . . 383
Trichodectes sphærocephalus . 383
— — posterior leg of . . 383
— scalaris 384
— equi 384
— latus 384
Hæmatomyzus elephantis . . 385
Haematopinus suis . . . 386

PAGE

Haematopinus, anterior leg . . 386
— quadrumanus . . . 387
Phthirius inguinalis . . . 387
— posterior leg of . . 387
Pediculus capitis, anterior claw of European . . 392
— — Andian Indian . . 392
— — North-American Slave lake Indian . 393
— — Australian . . 393
— vestimenti 394
— — sucker of ditto . . 394
Pediculus capitis 399
Tomocerus longicornis, scale of, magnified 402
— — part of do., more magnified 402
Machilis, scale magnified . . 402
— part of do., more magnified . . . 402
Lepidocyrtus curvicollis, scale magnified . . 403
— — part of do., more enlarged . . 403
Smynthurus fuscus . . . 406
— viridis 406
Papirius fuscus 408
Orchesella cincta . . . 409
Tomocerus plumbeus . . . 409
Lepidocyrtus curvicollis . . 410
Degeeria annulata . . . 411
Achorutes purpurascens . . 412
Podura aquatica 412
Lipura fimetaria . . . 412
Anoura muscorum . . . 414
Lepisma saccharina . . . 416
Machilis maritima . . . 416

INDEX.

	PAGE
ACARIDÆ	227
Acarina	93
Acarocecidium	353
Acaropsis mericourti	289
Acarus basteri	143
— crossi	270, 273
— dimidiatus	270
— domesticus	267
— farinæ	267
— favorum	267
— horridus	270, 273
— hyacinthi	257
— lactis	267
— nigua	194
— passularum	251
— spinitarsus	232
— translucens	275
— vespertilionis	179
— weekesii	273
Acarellus muscæ	247
Acercus	156
Achlysia	128
Achorutes purpurascens	412
Actineda cornigera	141
Actinopus nidulans	56
Adenopleura compressum	200
Æcidium abietinum	374
Agelena labyrinthica	77
Agelenidæ	72
Alycus	150
— roseus	150
Amaurobius ferox	75
— mordax	77
Amblyomma	187, 201
— pacificum	203
— rotundatum	201
American vine trumpet gall	335
Ancystropus zeleborii	180
Androctonus	38
— priamus	38
— sp.	38
— sp.	38
Anoplura	375
Anoura granaria	414
— muscorum	414
Arachnoidea	33
Araneidæ	43
Argas	180
— americana	182
— coriaceus	183
— miniatus	182
— moubata	182
— persicus	181
— pipistrellæ	180
— reflexus	181
— savignii	182
— talaje	183
Argasidæ	180
Argyroneta aquatica	72
Armadillo vulgaris	10
Arrhenurus viridis	156
Ash clusters	364
Astoma	129
— gryllaria	136
— parasiticum	129
Atax	145

PAGE

Atax bonzi 155
— globator 155
— histrionicus . . . 156
— miniata 155
— varipes 155
Atoma 128, 129
Atractides 156
Atypus sulzeri . . . 55, 69

BALLUS depressus . . . 92
Batoneus populi 368
Bdella egregia 144
Bdellidæ 142
Beckia argentea 410
Beetle mites 211
Bog mites 148
Bon, M., his manufacture of spider silk 47
Brachycybe rosea 21
British spiders 69
— mygalidæ 69
Brotheas 38
Bryobia 117
— speciosa 118
Buthus afer 37
— cæsar 38
— imperator . . . 38
— sp. 38

CALAMISTRUM of Ciniflo . . 76
Caligonus 124
— piger 124
Calyptostoma, Hardyi . . . 140
Campodea staphylinus . . 415
Carapato 201
Caris 128
Cecidoptes pruni 363
Celeripes 176
Cellularia 229
— bassani 230
Cephaloneon myriadeum . . 357
— pruni 360
— pustulatum 365

PAGE

Cephaloneon solitarium . . 358
Cepheus 221
— vulgaris 222
Ceratoneon attenuatum . . 359
— vulgaris 356
Cermatia 29
— capensis 30
— smithii 30
Cheese mites 227
Chelifer 34
— cancroides . . . 35
— geoffroyi 35
— musæorum . . . 34
Cheyletus 285
— eruditus 286
— mericourti 289
— robertsoni . . . 286
Chilognatha 14
Chilopoda 22
Chiracanthum nutrix . . . 71
Chorioptes 312
Ciniflo ferox 75
— mordax 77
Ciniflonidæ 72
— web of 76
Classification, general system of . 12
— of aptera 13
— — arachnoids . . . 33
— — mites 93
Clubiona epimelas . . . 71
— pallidula 71
Collembola 403
Craterium pyriforme . . . 119
Cryptops hortensis . . . 28
Cteniza fodiens 57
— ionica 56

DAMÆUS 215
— auritus . . 212, 216
— geniculatus . . . 215
Degeeria annulata . . . 411
Degeeridæ 408
Demodex caninus . . . 330

PAGE
Demodex folliculorum . . . 329
Dermacentor . . . 186, 199
— pardalinus 199
Dermaleichidæ 227
Dermaleichus 327
— bifidus 328
— chelopus 329
— musculinus . . . 326
— passerinus 329
— pici majoris . . . 329
— sp. 328
Dermanyssidæ 169
Dermanyssus 169
— agilis 174
— albatus 179
— arcuatus 179
— avium 169
— hirundinis . . . 172
— nitzschii 169
— pipistrellæ . . . 172
Dermatodectes 307
— bovis 308
— equi 308
— ovis 308
Dermatokoptes 307
— communis . . . 308
Dermatophagus 312
— bovis 313
Diæa dorsata 88
Dictyna arundinacea . . . 72
Dictynidæ 71
Diplodontus scapularis . . 153
Diplopoda 14
Diplostaspis arcuata . . . 179
— vespertilionis . . . 179
Docophorus 378
— icterodes 379
— semisignatus . . . 378
Dolomedes fimbriatus . . . 89
Drassidæ 70
Drassus blackwallii . . . 71
— micans 70
— sericeus 71

PAGE
Dysdera crocata 70
— rubicunda 70
Dysderidæ 69

EPEIRA arbustorum . . . 84
— bicornis 84
— diadema 85
— diademata . . 83, 85
— quadrata 84
— web of 84
Epiblemum scenicum . . . 92
Eremæus 222
— tibialis 222
Eresus cinnabarinus . . . 71
Ergatis benigna 72
Erineum 331, 353
— acerinum 358
— æsculi 371
— alneum 365
— aucupariæ . . . 362
— betulinum 366
— juglandinum . . . 370
— juglandis 370
— mali 362
— oxyacanthæ . . . 363
— populinum . . . 369
— pulchellum 367
— purpurascens . . . 358
— quercinum 371
— tiliæ 374
Erythræus 140
— corniger 141
— ruricola 141
Eschatocephalus gracilipes . 184
Eupalus 144
— vitellinus . . . 144
Eupodes 120
— celer 121
— hiemalis 120
Eylais extendens . . . 150

FALSE scorpions 34

PAGE

Flexipalpus tiliæ . . 341, 342
Fresh-water mites 147

Galeodes araneoides . . 40
Gall mites 331
Gamasidæ 158
Gamasinæ 157
Gamasus 158
— auris 167
— coleoptratorum . . 158
— crassipes 161
— gigas 160
— halophilus 166
— hilaris 159
— marginatus 159
— marinus 167
— maritimus 166
— podager 161
— quadripunctatus . . 161
— salinus 166
— testudinarius . . . 160
— tetragonoides . . . 161
Geophilidæ 22
Geophilus longicornis . 22, 23
— subterraneus . . . 23
Glomeris limbata . . . 14
Glyciphagus 276
— balænarum . . . 281
— buski 279
— cursor 278
— hippopodus . . . 278
— palmifer 283
— plumiger 282
— prunorum . . . 277
— spinipes 286
Goniocotes 379
— hologaster 380
Goniodes 380
— colchici 380
— dissimilis . . . 381
— falcicornis 380
— numidianus . . . 380

PAGE

Goniodes stylifer 380
— tetraonis 381

Halacaridæ 205
Halacarus 208
— ctenopus 208
— falcatus 208
— granulatus 210
— notops 211
— oculatus 210
— rhodostigma . . . 210
— sculptus 209
Halarachne halichæri . . 167
Hæmalastor . . . 187, 198
— gracilipes . . . 198
— longirostris . . . 198
Hæmaphysalis 199
— rosea 200
Hæmatomyzus 385
— elephantis . . . 385
Hæmatopina 384
Hæmatopinus 385
— acanthopus . . . 386
— asini 388
— eurysternus . . . 387
— lyriocephalus . . 386
— piliferus 388
— quadrumanus . . 389
— spinulosus . . . 386
— suis 386
— tuberculatus . . 388
— ventricosus . . . 386
— vituli 387
Harpactes hombergi . . 70
Harvest bug 109
— mites 117
Hecærge maculata . . . 71
Heliaczeus populi . . . 368
Heliophanes cupreus . . 92
Hermannia crassipes . . 221
— reticulata . . . 221
Heteropus ventricosus . . 290
Homopus 253

	PAGE
Homopus elephantis	253
Hoplophora	222
— arctata	225
— contractilis	222
Hyalomma	186, 196
— cornuger	196
— hispanicum	197
— syriacum	197
Hydrachna	151
— buccinator	155
— geographica	152
Hydrachnidæ	147
Hydrochoreutes globulus	153
Hydrodroma	152
Hydryphantes	152
Hygrobates	156
Hypoderas	229
— brevis	229
— columbæ	230
— lineatus	230
— unicolor	229
Hypoderidæ	227
Hypopidæ	227, 231
Hypopus	231
— alicola	250
— arvicola	236, 250
— dujardinii	257
— feroniarum	232
— filicum	235, 250
— muscæ	250
— muscarum	232, 234, 250
— pulicis	250
— sapromyzarum	232
Ichoronyssus	172
Ischnurus	38
Isopoda	8
Isotoma grisea	412
— viatica	411
Itch mites	291
Ixodes	190
— americanus	194
— bovis	193
Ixodes brevipes	194
— distipes	194
— dugesii	193
— erinaceus	190
— fodiens	191
— marginatus	192
— reduvius	193
— ricinus	193
— testudinarius	192
— trabeatus	193
— transversalis	195
Ixodidæ	185
Japyx solifugus	415
Julidæ	14
Julus	15
— guttatus	16
— londinensis	18
— nitens	18
— pulchellus	16
— terrestris	17
Kalips	67
Lælaps hilaris	15
Latrodectes lugubris	67
— malmignatus	65
Leiosoma	216
— nitens	216
— ovata	217
Leiostaspis zeleborii	180
Legnon circumscriptum	372
— crispum	356
Lepidocyrtus curvicollis	410
Lepismadæ	415
Lepisma saccharina	416
Lepronyssus	172
— lobatus	174
— rubiginosus	174
Leptus	128
— autumnalis	109
— phalangii	145
Leptognathus falcatus	208

PAGE

Lice 375
Limnesia fulgida 152
Limnocharis 148
— aquaticus 148
— holosericeus . . . 148
Linopodes 122
— cursorius . . . 123
— longipes 122
— ravus 123
Linyphiidæ 82
Linyphia montana . . . 82
Liotheidæ 376
Lipeurus 381
— jejunus 382
— polytrapezius . . . 382
— squalidus 382
— stellaris 381
— variabilis 382
Liponyssus 172
— setosus 173
Lipura fimetaria . . . 412
— maritima 413
— stillicidii . . . 414
Listrophorus 324
— gibbus 325
— leuckarti 325
Lithobius forficatus . . . 28
Louse-mites infesting birds . . 327
Lycosa allodroma . . . 91
— tarantula . . . 67, 68
Lycosidæ 67
— British 89

Machilis 402
— maritima 416
— polypoda . . . 416
Macronyssus 172
Mallophaga 376
Malotrichus carpini . . . 367
Marica 156
Marine mites 205
Marmignatto 66
Mecistocephalus punctifrons . . 22

PAGE

Megamerus 115
— celer 115
— ovalis . . . 122, 123
Melichares agilis 174
Menopon 376
— fulvo maculatum . . 377
— pallidum . . . 376
— perdricis 377
Micrommata virescens . . 88
Microphtheridæ 128
Micaria pulicaria . . . 70
Moggridge, Mr., researches on trap-door spiders . . . 61
Molgus 143
— longicornis . . . 143
Mud mites 148
Mygale avicularia . . . 52
— californica . . . 53
— convexa 54
— detrita . . . 55, 65
— erichsoni 54
— fasciata 54
— klugii 54
— versicolor . . . 54
Mygalidæ 51
— British 69
Myobia 315
— coarctata . . . 315
— musculi 315
Myocoptes 325
— musculinus . . . 326
Myriapods 12

Nemesia cæmentaria . 58, 60
— eleanora . . . 58, 60
— meridionalis . . . 59
Neriene 83
Nesea 156
Nirmus 379
— cameratus . . . 379
— claviformis . . . 379
Notaspis 217
— bipilis 217

	PAGE
Nothrus	219
— horridus	220
— spiniger	219
Norwegian itch	300
OBISIUM	35
— carcinoides	35
Ocypetus	128
Oniscidæ	8
Oniscus asellus	8
Oonops pulcher	69
Ophiodes	203
— flavomaculatus	204
— gervaisii	204
— gracilentus	204
— ophiophilus	204
Opistophthalmus	38
Orchesella cincta	408
Oribata	217
— globula	218
— notata	218
— orbicularis	217
— ovalis	218
— punctata	218
Oribatidæ	211
Oribatinæ	93
Ornithobius	382
— cygni	383
Ornithodoros	183
— coriaceus	183
— talaje	183
Otonyssus	317
— sticholasius	323
Oxyopes lineatus	91
PACHYGNATHA	83
Pachygnathus	127
— minutus	211
— notops	211
— sculptus	209
— seahami	211
— velatus	128
Papirius fuscus	408
Papirius ornatus	408
Pauropus huxleyi	32
— pedunculatus	32
Pediculus	391
— capitis	399
— — Andian	400
— — Australian	400
— — British	399
— — Californian	400
— — Esquimaux	399
— — Fuegian	400
— — Hindoo	400
— — Mosambican	400
— — Russian	399
— — West Africa	400
— muris musculi	315, 326
— vestimenti	394
Pedipalpi	34
Pelops	218
— acromios	219
Penthaleus	121
— hæmatopus	121
— insulanus	122
Penthalodes	123
— ovalis	123
Peplonyssus	323
— pagurus	324
— seminulum	324
Periglischrus asema	177
— caligus	177
— rhinolophinus	177
Petrobia	118
— lapidum	118
Philodromus pallidus	88
— margaritatus	88
Pholcidæ	79
Pholcus phalangioides	79
Phrynidæ	39
Phrynus ceylonicus	39
— palmatus	39
Phthirius	389
— inguinalis	389
Phyllerium	353

PAGE

Phyllerium alnigenum . . . 366
— axillare 371
— juglandis 370
— liliaceum . . . 356
— vitis 363
Phytopti on alder . . 363, 364
— on beech 371
— on elm 365
— on hornbeam . . . 366
— on pear tree . . . 362
— on Scotch fir . . . 372
— on walnut . . . 370
— on willow 367, 368, 369, 370
Phytoptidæ . . . 227, 331
Phytoptus aceris . . . 356
— attenuatus 359
— on Bromus . . . 373
— carpini 367
— coryli 354
— myriadeum . . . 357
— on maple . . . 373
— on mulberry . . . 364
— on salvia . . . 373
— on strawberry . . . 373
— persicæ 354
— pruni 360
— pyri 358
— ribis . . 339, 343, 355
— salicis . . 337, 339, 361
— taxi 354
— tiliæ . . 332, 339, 356
— tiliarius 356
— vitis 343
Physogaster larvarum . . . 290
Pimelonyssus . . . 172
— biscutellus 174
Piona 156
Podura aquatica 412
Poduridæ 412
Polydesmus 19
— complanatus . . . 20
— dorsalis 20
Pond-water mites . . . 150

PAGE

Pontarachna punctulum . . 156
Porcellio scaber . . . 10
Proctophyllodes 328
Pseudo scorpiones . . . 34
Psoroptes 307
— equi 308
Pterodectes 328
Pterolichus 327
Pteronyssus 327
Pteroptidæ 175
Pteroptus vespertilionis . . 179
Ptilopteridæ 378

Raphignathus 114
— ruber 115
— ruberrimus 114
Rhagidia gelida . . . 120
Rhipicephalus . . 187, 200
— senegalensis . . . 200
Rhizoglyphus 255
— echinopus . . . 257
— feculæ 259
— mycophagus . . . 262
— phylloxeræ . . . 258
— robinii 259
— rostroserratus . . . 260
Rhyncholophus . . . 124
— cinereus 125
— major 126
— phalangioides . . . 125
Rhynchoprion columbæ . . 181
River-water mites . . . 152
Rœstelia cancellata . . . 374
— lacerata 374

Salticidæ 91
Salticus cupreus 92
— formicarius . . . 92
— obscurus 92
— scenicus 92
Sarcodermatodectes . . . 312
— capreæ 313
Sarconyssus 195

	PAGE
Sarconyssus nodulipes	196
Sarcopterus nidulans	314
Sarcoptes	291
— bovis	303
— capræ	302
— cati	302
— cuniculi	302
— dromedarii	305
— minor	302
— mutans	305
— rupicapræ	305
— scabiei	290, 292
— scabiei-crustosæ	300
— squamiferus	302
— subcutaneus	228
— vulpis	302
Sarcoptidæ	291
Scirus	144
— hexophthalmus	146
— insectorum	145
— obisium	146
— vestitus	146
— vulgaris	144
Scolopendra	24
— angusticollis	27
— cœruleoviridis	27
— ceylonensis	26
— electrica	23
— leachii	27
— morsitans	24
— placeæ	26
— platypoides	26
— tuberculidens	27
— variegata	26
Scolopendridæ	22
Scorpionidæ	34
Scorpions	36
Scutacarus femoris	253
Scyphius	122
— diversicolor	122
Scytodes thoracica	79
Scytodidæ	78
Segestria senoculata	70
Seira buskii	410
Sejus	164
— auris	167
— halophilus	166
— marinus	167
— maritimus	166
— salinus	166
— viduus	164
Smaridia	126
— papillosa	127
Smaris	149
— expalpis	149
— impressa	149
Smynthuridæ	406
Smynthurus fuscus	406
— niger	408
— viridis	407
Snouted mites	142
Solpugidæ	40
Sparassus smaragdulus	88
Sphasidæ	91
Sphasus lineatus	91
Sphæropœus castaneus	15
— glabratus	15
— heterostictus	15
Spiders	43
Spiders, British	69
Spiders' nests with cork doors	64
— — with wafer doors	67
— — silk of	45
— — trap-door	56
Spinning-mites	97
Spinturnia	176
Spirostreptus annulatipes	19
— javanicus	19
Spring tails	401
Steatonyssus	172
Stigmæus	124
— cruentus	124
Sugentia	20
Symbiotes	312
— bovis	313
— elephantis	253

	PAGE
Symbiotes equi	313
TARANTISMUS	67
Tarantula	67
Tegenaria domestica	78
— guyonii	78
Telyphonus giganteus	39
— proscorpio	40
Templetonia crystallina	410
Tendaraman	66
Tetranychidæ	97
Tetranychus	97
— americanus	116
— autumnalis	109
— cucumeris	102
— eriostemi	109
— ferrugineus	103
— fici	107
— irritans	116
— lintearius	104
— prunicolor	96
— rosarum	102
— russulus	103
— socius	108
— sp.	107
— Taxi	354
— talsahuate	113
— telarius	97
— — var. cinnabarinus	101
— — var. hæmatodes	101
— — var. tini	101
— tiliarum	107
— trombidinus	114
— vitis	103
Theraphosidæ	69
Theridiidæ	65, 79
Theridion benignum	67
— lineatum	81
— pallens	81
— riparium	80
— tepidariorum	80
— tredecimguttatum	66
Thomisidæ	86
Thomisus abbreviatus	88
— audax	88
— floricolens	88
— onustus	88
Thyas	148
— venusta	149
Thysanura	401
Ticks	185
Tinoglischrus audoninii	178
— punctolyra	178
Tomocerus longicornis	402, 409
— plumbeus	409
Trap-door spiders	56
Trichodactylus	251
— osmiæ	251, 252
— xylocopæ	252
Trichodectes	383
— equi	384
— latus	384
— longicornis	383
— scalaris	384
— similis	383
— sphærocephalus	383
— subrostratus	384
Trichodectidæ	383
Trichoxyreus, sp.	364
Trinoton	378
— luridum	378
Trochosa cinerea	91
Trombidiidæ	117
Trombidiinæ	95
Trombidium	128
— aphidis	139
— aurantiacum	139
— bicolor	135
— bulbipes	136
— celer	121
— curtipes	134
— fasciculatum	135
— fuliginosum	95, 134
— gryllarium	136
— holosericeum	96, 129
— miliare	134

	PAGE
Trombidium miniatum	139
— parasiticum	129
— phalangii	129
— sericeum	138
— tinctorium	135
— trigonum	133
Tydæus	120
— mutabilis	120
Typhlodromus mali	362
— pyri	340, 358
Tyroglyphidæ	227, 255
Tyroglyphus	255, 263
— echinopus	257
— entomophagus	263
— feculæ	259
— longior	270
— malus	275
— mycophagus	242, 262
— phylloxeræ	258
— siculus	274
— siro	267
— translucens	275

	PAGE
ULOBORIDÆ	86
Uloborus walckenaerius	86
Uropoda	162
— vegetans	162
VASATIS	373
Vejovis	38
Veleda lineata	86
Volvella coronillæ	372
Volvellina marginalis	362
Volvulifex aceris	356
— rhodizans	367
WALCKENAERIA pratensis	82
XIPHIASTOR	201
— rostratus	201
Xysticus audax	87
— cristatus	86
— pini	88
ZERCON dimidiatus	167

THE END OF VOLUME I.

BRADBURY, AGNEW, & CO., PRINTERS, WHITEFRIARS.

LANE MEDICAL LIBRARY

To avoid fine, this book should be returned on or before the date last stamped below.

OCT 5 1966
APR 28 1976

D1201 Murray, A. 91289
M98 Economic entomology
Aptera

NAME

DATE DUE

D1201
M98